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UNCINARIASIS

(HOOKWORM DISEASE)

IN PORTO RICO

A MEDICAL AND ECONOMIC PROBLEM

BY

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AND

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MEMBERS OF THE FORMER PORTO RICO ANEMIA COMMISSION
SAN JUAN, PORTO RICO, AUGUST 5, 1910

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

IN THE SENATE OF THE UNITED STATES.

FEBRUARY 6, 1911.

Resolved, That the report entitled "Uncinariasis (Hookworm Disease) in Porto Rico; a Medical and Economic Problem, prepared under the direction of the Secretary of War, in the Surgeon General's Office, by Major Bailey K. Ashford, Medical Corps, United States Army, and Pedro Gutierrez Igaravidez, Director of Tropical and Transmissible Diseases, Service of Porto Rico, members of the former Porto Rico American Commission," be printed, with illustrations, as a Senate document.

CHARLES G. BENNETT, *Secretary*,
By H. M. ROSE, *Assistant Secretary*.

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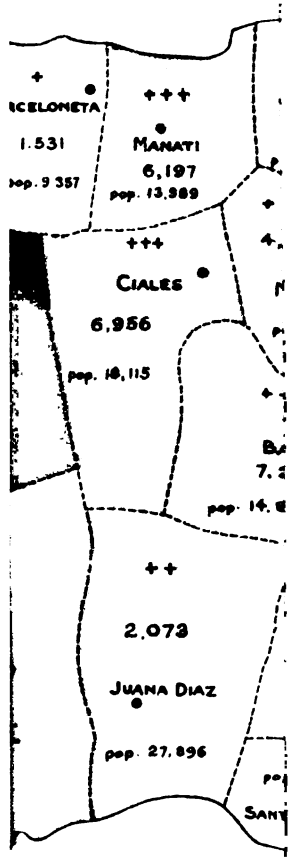

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UNCINARIASIS ("HOOKWORM DISEASE") IN PORTO RICO.

INTRODUCTION.

For the past year or more the original members of the Porto Rico Anemia Commission have desired to see in one concise volume the substance of their reports and researches which from time to time have appeared in the form of official publications, articles in medical journals of the United States, and addresses to medical bodies. In addition to this we had accumulated a large amount of data as yet unpublished, which threw much light upon important phases of the work, from a scientific as well as from an economic standpoint.

After his visit to the island in December, 1909, the honorable Secretary of War of the United States, having come into direct contact with this work and its results in Porto Rico, and at the request of Dr. Henry S. Wellcome, of England, made known his wish that a fully compiled work, comprising the results of all operations of the commission and its successive services, be prepared and sent him for publication by the Department of War.

This volume is in obedience to that wish.

As all of the reports and other articles on uncinariasis have been prepared by the three members of the first anemia commission together, or by two acting for the commission, or by one, associated with two members of a later organization (reports of 1906–7 and 1907–8), but still acting for the work as first constituted, we feel, in signing this compilation of our work, that the name of Walter W. King, passed assistant surgeon, United States Public Health and Marine-Hospital Service, should be indelibly stamped upon it. He was the third member of the first Porto Rico Anemia Commission, a body which had no more complex organization than the simple association of three men for the study and treatment of anemia in Porto Rico, and in which each member formed merely the third part of that body. Preserving that spirit of association in all of our subsequent writings, we have felt that no dissolution of a peculiarly strong bond, such as this has been and still is, could be possible. So that in his absence we desire to make manifest that his important part in the work herein recounted should not be overlooked.

At the same time we wish to make clear the fact that Dr. Pedro Gutierrez has personally guided the fortunes of this work since 1906, and that for two years Drs. Francisco Sein y Sein and Isaac Gonzalez Martinez formed with him the second Porto Rico Anemia Commission. A prominent feature of this campaign has been the personal service with the anemic rendered by every medical officer of the organization, from the commissioners to the director of the smallest substation. It should be added, therefore, that if the labor of preparing

reports and of making the clinical and laboratory investigations, which are herein set forth, is the work of the three original members of the commission, it is also to the everlasting credit of the physicians in the country districts of the island that they have by patient and unremitting labor brought nearly one-third of the people of Porto Rico under treatment for uncinariasis and have made a startling change in the physique of laborers in and around its towns. To mention any one of them without mentioning all would not be just to the others, and we feel that to each and all of them a tribute of gratitude is due which their people can never repay.

This work has been fostered by the Army of the United States at all times, aided for a time by the Public Health and Marine-Hospital Service, which permitted one of its officers, Dr. King, to take part in the years 1904 and 1905; it has been protected and personally assisted by all of the Governors of Porto Rico from its inception; it has been made a policy of the insular government by the Legislature of Porto Rico, both houses of which have voted substantial sums of money for its successful accomplishment year after year; and, lastly, it has been assured a long life by the vigorous appeals of the Porto Rican people, through their municipal governments, to preserve its existence and continue its activity.

Each contribution has been different, but from its birth in the Army of the United States to its healthy maturity in the civil Government of Porto Rico, the sum total has been a work in which the island has reason to feel gratified.

In compiling this work we have omitted from the summary of the reports of the commission all material referring to the clinical features of uncinariasis and have written a separate chapter to cover this subject. The medical reader will note that we do not employ the term "hookworm disease." We prefer uncinariasis. The original commission adopted this term from Dr. Charles Wardell Stiles's "*Uncinaria americana*" and in deference to that zoologist. Later he changed the name of the worm to "*Necator americanus*," but we are unable to change the name we have given the disease in Porto Rico where it is universally employed. We recognize the right of the zoologist to rectify errors in the nomenclature of a parasite, but the medical profession is not compelled to change their terminology for a disease. The medical profession alone should decide this question, and we therefore await their decision. We can only add in this connection that "uncinariasis" is a fairly clear scientific translation of "hookworm disease," and we believe more consistent with the traditions of medical nomenclature which seeks to place in one of the classical languages a term which will be understood by the physicians of all nations. Up to the present date uncinariasis is a term employed in many textbooks in America and in some abroad. It is by no means the only one employed to describe the disease, but it is very commonly used.

In conclusion, we wish to express especially our appreciation of interest and assistance extended us by the honorable governor of Porto Rico. Gov. Colton has evidenced in many practical ways his desire to eradicate the disease from the island, and to that end is carrying on a personal campaign with the end in view of securing the cooperation of municipal governments and prominent business men in the island.

CONDITIONS AFFECTING UNCINARIASIS IN PORTO RICO.

In order to fully comprehend the conditions that have brought about the disastrous pandemic of uncinariasis in Porto Rico it is necessary to make a brief summary of social and economic conditions in the island since its discovery to the present day. We are indebted for the historical data to Mr. Salvador Brau ("Puerto Rico y Su Historia," Valencia, imprenta de Francisco Vives Mora, 1894), and to Dr. Cayetano Coll y Toste, who furnished the material from which the early history of the island was set forth in Gen. George W. Davis's remarkable Report of the Military Governor of Porto Rico on Civil Affairs, Washington, Government Printing Office, 1902, the most extensive and complete work on the early American history of the island extant.

For our knowledge of the life of the jibaro previous to the American occupation of the island, we wish to especially acknowledge our indebtedness to the exquisitely written book of Dr. Francisco Del Valle Atiles, a literary effort of the highest type, entitled "El Campesino Puertoriqueño," Puerto Rico, tipografia de José Gonzalez Font, Fortaleza, numero 27, 1889, and also to the writings and personal assistance of the well-known author and poet, Don Manuel Fernandez Juncos.

In our summary of labor conditions in Porto Rico we have made liberal demands upon statistics contained in Labor Conditions in Porto Rico, by Walter E. Weyl, Ph. D., Bulletin of the Bureau of Labor, Department of Commerce and Labor, No. 61, November, 1905, who visited our field hospital in Aibonito in 1905, and with whom these conditions, which he so aptly describes, were studied to a considerable extent.

While these and other works have greatly aided us, we always express our own opinion in judging of the general conditions which prevail among those whose disease we are called upon to study and combat.

COMMENTS ON THE EARLY HISTORY OF PORTO RICO.

Although the earliest historians of the island (Bartólome de las Casas) report that there were 600,000 Indians at the time of the discovery, there is little doubt but that this is a crass error. Sixty thousand seems to be excessive, for 20 to 25 years later there were not enough Indians to work in the gold mines. Coll y Toste[1] fixes the Indian population at the time of the conquest at 63,000.

We have been unable to find any account of disease or physical debility possessed by the Indians when the Spaniards first arrived.

[1] C. Coll y Toste. Prehistoria de Puerto Rico, San Juan, 1907, p. 92, note.

Christopher Columbus, writing at sea on the return from his first voyage to America, reports to the King:

The people of this and of all islands I have found * * * go about as nude as they were the day their mothers bore them, men and women * * *. They have neither iron nor steel nor arms, nor are they made for such things; not because they are not a people of good disposition, nor because they do not possess a fine stature, but because they are very timid, marvelously so * * *. In these islands, so far, I have never found men monsters, as many thought I would find; on the contrary, all are people of very beautiful presence.

La gente desta isla é de todas las otras que he hallado * * * andan todos desnudos, hombres é mugeres, asi como sus madres los paren * * *. Ellos no tienen fierro, ni acero, ni armas, ni son para ello; no porque no sea gente bien dispuesta é de fermosa estatura, salvo que son muy temerosos á maravilla * * *. En estas islas fasta aqui no he hallado hombres monstrudos como muchos pensaban; mas antes es toda gente de muy lindo acatamiento. * * * (Puerto Rico y su Historia, by Don Salvador Brau. Valencia, 1894, p. 376.)

These people were reduced to slavery by the Spanish conquerors. They were divided up into groups of from 100 to 200 men, which were distributed around among the Spaniards for the purpose of working the gold mines. The Indian villages were inhabited by the old women and children, who were compelled to furnish the slaves their rations. The women of marriageable age were appropriated as concubines. This enforced labor, to which they were not accustomed, and the separation of the sexes naturally caused a tremendously rapid decrease in numbers of the indigenous population, and the ravages of syphilis and, beginning in 1518, smallpox, completed their annihilation as a pure race.[1 2 3]

In fact, no author of early date mentions any disease but syphilis, smallpox, and tetanus. The only apparent exception to this is found in a statement of the treasurer of the island, Andres de Haro, who, writing the King, January 21, 1518, says in explanation of the great diminution of the Indians and the remedies employed to prevent their extinction:

Although now great care is taken for their good treatment, withal they diminish in numbers, because, as they are incapable in matters of the faith, they are equally so in that which concerns their health, and are of very weak complexion.

Aunque ahora se tiene gran cuidado en su buen tratamiento, con todo se disminuyen, porque como son incapaces en las cosas de la Fe, lo son en lo que toca á su salud y de muy flaca complexion.

We fancy that De Haro, official of the island and to a certain extent responsible to the King who had been commanding more merciful treatment of these poor slaves, wished to say that they died because they were of a naturally weak constitution ("weak complexion"). He seems to be oblivious of the facts of grinding slavery, imported plagues, and separation of families, which we would be led to believe were not enough to exterminate a race without a weak constitution.

---

[1] Antonio Maria Fabié. Vida y Escritos de Don Fray Bartolomé de las Casas, Obispo de Chiapa. Madrid, 1879, 2d vol., p. 228:

"Segun los oficiales reales de Puerto Rico, la falta de mantenimientos, el daño de las tormentas y la peste de viruelas, acabaron de diezmar los pocos Indios que quedaban."

[2] Fray Iñigo Abbad y Lasierra. Hist. geog. civil y natural de Puerto Rico, 1866, p. 140. This author states that in 1582, according to the report of Capt. Melgarejo to King Phillip the Second, not an Indian remained of those found in the island at the time of Columbus's visit. There were, however, a few from Venezuela. In this same report we see that people of the capital of the island enjoyed good health, as did those of San German, and were not pallid. This old chronicler states: "La cibdad de Puerto Rico es tierra sana, comunmente andan los hombres con buenos colores * * *. En Nueva Salamanca (San German) es lo mismo." That is to say, "The city of Puerto Rico is healthful land; commonly men go about with good color * * *. In San German it is the same."

[3] Cayetano Coll y Toste's Repertorio Historico de Puerto Rico, 1896, ch. 5, pp. 441, 42.

This is the true vein in which he speaks, we believe, and we can not see that he was referring to anemia, which contemporaneous writers fail to mention.

THE INTRODUCTION OF THE NEGRO.

With the threatened extermination of the Indian slave, the Spaniard saw the necessity for importing labor, and in the coming of the negro slave we can see the beginning of what later proved to be the greatest curse Porto Rico has ever suffered, epidemic uncinariasis, or "La Anemia." Before touching upon the slave trade, which brought the negro to Porto Rico, let us pause for a moment to gather some data concerning the species of "hookworm" commonly found in the island: This is almost without exception the New World species, or "*Necator americanus*." Looss, in a "Note on Intestinal Worms Found in African Pygmies"[1] says:

> The principal object of this note is to state the occurrence of the "New World hookworm" in natives of Central Africa and to attract the attention to its probable occurrence in other parts, especially the coasts of tropical Africa.

This is confirmed by a correspondence carried on between Dr. Gutierrez and Dr. Fisch, of Aburi, a German physician in the Gold Coast. The latter sent to Dr. Gutierrez specimens of "uncinariæ" which he had been finding in 20 per cent of all negroes of the Gold Coast he had examined, and upon receiving them Dr. Gutierrez immediately recognized them as being identical with those we had been familiar with here. This identity was later confirmed by Dr. Fisch. Dr. Fisch objects to the name "*Necator*," on the ground that it is a trifle too "terrific," and to "*americanus*," because he believes that the slave trade carried it from Africa, its true home, to America, its adopted "Patria."

In 1518 the friars advised the King to send for negroes to the coast of Guinea, and from this came "la trata," or the trade. In 1534 there were six negroes for every Spaniard. This trade went on, by concessions and probably surreptitiously, quite steadily until about 1765, and from that time on until the early part of the nineteenth century negroes were introduced on a large scale. In 1817 this trade was abolished.

It is reasonable to suppose that uncinariasis secured its first foothold in the island about the date of the founding of the first three sugar plantations with their mills. This, according to Dr. Coll y Toste, occurred in 1530.

Thus the first infested soil seems to have been coast land, and the disease for a long time limited itself to the coast, i. e., until coffee culture became the mountain industry.

Coffee was first brought to Porto Rico in 1736 from some trees transferred to Martinique from the botanical gardens of Paris by M. Gabriel Declieu in 1720. (Coll y Toste.) In 1779 coffee began to be of importance. In 1770, seven to eight thousand hundredweight were produced. In 1863 coffee culture was of vast importance and had well invaded the mountain districts (heretofore it had been a product of the coast and foothills).

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[1] Notes on African Pygmies, by G. Elliott Smith, London Lancet, August 12, 1905.

In the course of events following the extinction of the unhappy "Boriqueño," or Indian, and the introduction of the negro we begin to run across the trail of uncinariasis.

In 1765 the King ordered Field Marshal Alexander O'Reilly, who visited Porto Rico, to report on the social, fiscal, industrial, military, and religious conditions of the island. Writing in that year, he remarks:

> These people, lazy as a class, unrestrained by the Government, extended over the mountains and valleys of Porto Rico, built themselves miserable hovels, and with two or three plantains, together with native fruits and the number of cattle which roamed among the mountains, they procured fruit, vegetables, milk, and some meat, and upon these lived, and so even now continue. These men were worthless and lazy, they possessed no implements, had no knowledge of agriculture, had no one to assist them in their work or aid in clearing the forests; therefore how could they advance? To encourage such laziness there was a balmy climate. * * * (Report of the Military Governor of Porto Rico on Civil Affairs, Washington, Government Printing Office, 1902, by Brig. Gen. George W. Davis, U. S. Army, p. 88.)

The Benedictine friar, Iñigo Abbad, 1778, does not fall behind the others in bewailing the poverty and improvidence of the "natives."

Col. George D. Flinter, an Englishman in the service of Spain, published "An account of Porto Rico," in 1834. In this expression of opinion we find:

> The common white people, or lowest class (called jibaros), swing themselves in their hammocks all day long, smoking cigars and scraping their native guitars * * *
>
> Voyage aux iles de Tenerife, La Trinité, Saint-Thomas, Saint Croix et Porto Ricco, exécuté par ordre du gouvernement français (1796–1798) par André Pierre Ledru, 1810, volume 2, page 169:
>
> "La plupart de ces colones sont, en general, d'une paresse et d'une insouciance inconcevables * * * . Couchés dans leurs hamacs, ils s'y bercent une partie du jour, occupés á recibir le rosaire ou á fumer * * * Leurs enfants, élevés loin des villes, sans education, et vivant avec les jeunes négres de l'un et de l'autre sexes, dans la plus grande familiarité, contractent trop souvent des habitudes corrompues, et deviennent cruels envers leurs esclaves."
>
> "Most of these colonists are inconceivably lazy and indifferent. Lying back in their hammock, the entire day is passed praying or smoking. Their children, isolated from the cities, without education, live in social equality with the young negroes of both sexes, acquiring perverted customs, only to later become cruel with their slaves."

What if these people were merely innocent victims of a disease, modern only in name? What if the brand placed by the Spaniard, the Englishman, and the Frenchman in olden times upon the "jibaro" of Porto Rico were a bitter injustice? The early reports savor strongly of those touristic impressions of the island which from time to time crop out in the press of modern America, in which "laziness" and "worthlessness" of the "natives" are to be inferred, if, indeed, these very words are not employed to describe a sick workingman, with only half the blood he should have in his body.

True, Col. Flinter, Field Marshal Count O'Reilly, and the rest of the long list of early "observers" did not know what uncinariasis was. But it is necessary that we have a record of microscopic examinations of the feces of the people they describe to realize what can be read between the lines? Convicts, adventurers, and gypsies may have formed part of the element that colonized Porto Rico, but we can not believe that these were all nor that their descendants were of necessity "lazy" and "worthless."

We can not believe that vicious idleness comes natural to the Spanish colonist, even in the Tropics, for the very reason that we have seen these descendants at their very worst, after the neglect of four centuries of their mother country, and after the laborious increase of an anemic population in the face of a deadly disease, whose nature was neither known nor studied, work from sunrise to sunset and seek medical attention, not because they felt sick, but because they could no longer work.

We strongly feel that these writers have unconsciously described uncinariasis. Are the Spanish people considered "lazy" by those who know them? Were those Spaniards who conquered Mexico, Peru, all South America; who formed so formidable a power in the middle ages, a lazy people?

Is it "laziness" or disease that is this very day attracting the attention of the United States to the descendant of the pure-blooded English stock in the Southern Appalachian Range, in the mountains of Carolina and Tennessee, the section of our country where the greatest predominance of "pure American blood" occurs, despised by the negro who calls him "po' white trash?"

LABOR CONDITIONS—BRIEF DESCRIPTION OF THE ISLAND, ITS INDUSTRIES, AND ITS WORKING CLASSES IN THE COUNTRY DISTRICTS.

While it would be of extreme interest to determine the latest statistical facts regarding Porto Rico, forthcoming in the census now being taken, the information found in the first American census taken in 1899 should be the basis for an accurate estimate of the conditions confronting the island upon the inauguration of its campaign against "anemia." The data contained, therefore, in the report on the census of 1899, together with our own observations and those made by Dr. Walter E. Weyl, the Government expert in the Department of Commerce and Labor (Labor Conditions in Porto Rico, work cited), may be succinctly stated as follows:

PHYSICAL CHARACTERS.

The island of Porto Rico is rectangular, 100 miles long by 36 wide, stretching from latitude 17° 50′ to 18° 30′ north, and from longitude 65° 30′ to 67° 15′ west. It is therefore entirely within the Tropics. It consists of a range of hills and mountains running east and west, with a maximum altitude slightly over 3,600 feet, and sloping toward the coast, gradually on the north, abruptly on the south. This area of 3,606 square miles is chiefly high and from the range of mountains which form the water divide of the island hundreds of small rivers and streams flow northward and southward to the coast. The temperature rarely rises to 100° F., and for a long period the average annual temperature has ranged on the northern coast from 78° to 82° F. The coolest month in the year is January, with a temperature averaging about 75, while in August, the hottest month, the average is about 82. There is a daily sea breeze and the evenings are cool. This is especially true of the highlands, which are delightful throughout the year. The humidity is high, averaging in San Juan about 80 per cent. Rainfall is heaviest on the northern coast, averaging about 60 inches in San Juan, and two-thirds of this falls in the summer and autumn. There is no true rainy season, but from about Septem-

ber to January is the period when most rain can be expected, this time coinciding exactly with the coffee harvest.

POPULATION AND RACE.

The population of Porto Rico in 1899 was 953,243, giving a density of 264 to the square mile. This population is very evenly divided throughout the seven districts, the most thickly settled being about double that of the most sparsely populated. The west and north are more heavily populated than the east and south. Only 8.7 per cent live in towns of over 8,000 inhabitants, and the total urban population in all towns of 1,000 or over was, in the census year of 1899 203,792. This leaves 749,451 who live in the country and in villages, or about 725,000 persons who can be really classed as country dwellers. Many of these country dwellers are of highly respectable old families of good position in life, who live in relative comfort in good houses. Grouped around the estates of these people lives the working class, the "jibaro," who has been appealing for aid at our dispensaries.

Sixty and eight-tenths per cent of the people of Porto Rico are white, according to the 1899 census; this Dr. Weyl seems to doubt, and it would be very difficult to unravel the confusion of races given the dark skin, the heritage of the Spaniard of the south of the peninsula from whom so many jibaros directly proceed, and the attenuation of the negro admixture, which undoubtedly took place to some extent in the earlier days of the colony. In spite of a reasonable doubt of pure blood raised by Dr. Weyl for at least a portion of those called "white," certain it is that the vast majority of the mountain people should be considered white. For the rest we note traces of the negro, and, not rarely, hints of the Indian. In addition to these whites there are, of course, some mulattoes and a few negroes. On the coast, however, the negroes and mulattoes are much more in evidence. Dr. Francisco del Valle explains this by stating that the white man took naturally to the mountains for the shade and lower temperature they afforded, while the negro, reveling in the warmth of the coast, worked happily in the broiling sun of the sugar lands.

While the increase in population has been fairly steady, it has been (up to within five years ago) getting slower and slower. Shortly after the cyclone it well-nigh stopped for a year. The decennial rate of increase in population, which was 57 per cent in 1765–1775, had declined to 16 per cent in 1887–1889. This increase has taken place in the face of a very high death rate in a dense population. As an example of this it was seen that the birth rate exceeded the death rate of 40 per 1,000 in 1899. Thirty and nine-tenths per cent of the entire population of Porto Rico are under 10 years of age (1899), a greater percentage than that of any civilized country in the world, yet in Porto Rico only 9 per cent are over 50 years of age, as against 13.4 per cent in the United States.

This gradual retardation of increase in population since 1775 and the shortened life of the Porto Rican as compared with that of the inhabitants of other countries should be contemplated in the light of the facts of this fearful pandemic of "anemia," which has been claiming its annually increasing number of victims, until in the fiscal year 1900–1901 11,885 deaths of a total of 35,781 were officially charged to it, or 33.2 per cent of the total death rate.

AGRICULTURE.

As agricultural labor is the full three-fourths of all labor performed on the island, and as Porto Rico depends almost entirely upon agriculture for her welfare, a few facts concerning her chief products will not be amiss.

In 1899 almost 21 per cent of the island was under cultivation. That there is a vastly greater area now can not be doubted, as the increase in sugar lands has pushed tobacco up into the hills and encroached largely upon the coffee plantations, a menace to the forest and to the water supply of the coast, it is true, but not without its benefit to the sufferers from anemia from the drying up of breeding places for uncinariasis.

In 1899, 41 per cent of all cultivated land was devoted to coffee culture, 15 per cent to sugar cane, 14 per cent to bananas, 8 per cent to sweet potatoes, 4 per cent to Indian corn, 2 per cent to malangas, 2 per cent to rice, 1 per cent to cocoanuts, and only 1 per cent to tobacco. In 1897, according to Coll y Toste, the value of the coffee crop was $12,222,599, that of the sugar crop $4,007,992, and that of the tobacco crop $1,194,318, all of these sums in provincial money. But the proportion between the three reigning products of the island has been completely revolutionized since that date. From forming 70 per cent of the value of all the exports from the island in the three years 1895–1897, coffee has reached a point where it contributes but a scant 15 per cent to the total value of exports. According to the report of the governor for 1907–8, the total exports were valued at $30,644,490, of which sugar gave $18,690,504, tobacco $5,410,195, coffee $4,304,609, and fruit $1,159,427. The downfall of coffee means the degradation of the industry of the white man in the mountains. Although the production of coffee has fallen off materially, the price of coffee has fallen still more, and the coffee planter finds it extremely difficult to make his industry pay and thus properly remunerate his laborers. The coffee grove helps greatly in evenly distributing wealth throughout the island, wherein it differs from sugar, which is a capitalistic product. These holdings are relatively small and used to be very profitable when coffee brought $25 and even $32 a hundredweight, provincial money. Now, due to the fact that the privileges and preferential tariffs of Spain to her former colony are removed, coffee has been made to compete with Brazil, whose bean is much more cheaply produced and whose enormous output flooded the market and reduced the price of coffee all over the world. The especially fine grade of Porto Rican coffee, to which the Brazilian product can not be compared, is not known by Americans, and as a proof of this statement it will be seen from the last cited report that but 129,322 of the 35,000,000 pounds exported went to the United States in the fiscal year 1907–8. This in spite of the fact that foreign countries have a tax on Porto Rican coffee. The price has fallen to from $10.50 to $12 per hundredweight, gold.

Of all the blows that coffee has received, however, the great hurricane was the most severe. In that year the shade trees and coffee bushes under them, together with, in many instances, much of the machinery, etc., used in preparing this product for the market, were more or less completely destroyed. As the restoration of a destroyed coffee plantation takes five years, and as the coffee planters had

improvidently failed, in the midst of their wealth of former years, to lay by with frugality a proper portion of their gains, coffee culture has never recovered from its misfortune, especially as a great number of these planters had borrowed on the expected crop which was thus incontinently swept out of existence.

The output for the period 1895 to 1897 had been at the rate of about 50,000,000 pounds a year. In the cyclone year it fell to about 5,000,000 pounds, worth about $600,000, gold. The crop of 1900 reached 12,886,172 pounds and sold for 10.84 cents per pound.

Thus with the impoverishment of the Porto Rican coffee planter, staggering under a debt upon which his profits merely sufficed to pay the interest, unable not only to cultivate the land he had under cultivation before, but even to place as much as before under cultivation, came further wretchedness for the unfortunate "peon" or "jibaro" who depends upon this product for his life.

SOCIAL, LABOR, AND ECONOMIC CONDITIONS IN THE COUNTRY.

Forty-eight per cent of those 10 years of age or over were engaged in gainful occupations in 1899, or 2.2 per cent less than in the United States. Three-fourths of all men and boys engaged in any occupation in Porto Rico were employed directly in agriculture, and four-fifths of all males employed in any service on the island are reported as laborers.

There were in that year 1,670 breadwinners below the age of 10 years; 22.4 per cent of all children between 10 and 14 years were employed in gainful occupations, and one-half of all those between 15 and 19. When one considers that much of this child labor is employed in the coffee plantations and that this rarely fails to produce in them a profound anemia, child labor in Porto Rico gets to be a very serious problem.

The wage in this island is low. Weyl puts it at 30 cents in the coffee plantation. We find it now about 40 cents, but in the bad days after the cyclone the people worked for food and were even paid in bananas. Ten cents a day and bananas as a wage followed, and it has gradually worked up to the current wage of the present day. While this increase in the wage is apparently a great improvement some very important explanations must be made. An immense number of mountain people are unemployed save in the picking season. Weyl states that, from an examination of the books of coffee planters, the average worker is employed but four days in the week. In picking time, however, the daily wage is no longer paid, and instead the pickers receive 12 cents an "almud," a small conventional box full. A strapping man, where the berries are heavy on the trees, can pick about 6 almudes per diem. But "strapping" men are not the men we find, and the men, after all, play but a part in the coffee harvest. As a rule women and children, the latter often of very tender age, are turned out into the grove to pick coffee, and thus the larger the family the greater the profit to the head of the house. While every plantation has its regular quota of peons who live on the premises, all the planter can afford to pay to clean and care for the place in the nine months wait for a crop, in time of harvest this number is utterly insufficient to pick the berries as they ripen, and large bands of traveling laborers double and even treble the number of resident

laborers. A satisfactory arrangement often made is that honest working families are given land upon which to squat and raise bananas. Such land belongs to the property, but is not planted in coffee as it is not fitted for the plant. The jibaro thus gets a place to live and the benefit of the bananas he raises although not paid a wage; the planter gets land, unfit for coffee, enriched by bananas, gradually plants shade trees and coffee, and thus extends his plantation. In the end, if the squatter desires, he becomes one of the peons; if he does not, he goes elsewhere.

The picking of coffee is all too frequently done in the pouring rain, for the harvest coincides, as we have seen before, with the wet weather. The vast majority of the pickers now, and all before the campaign against anemia began, are barefooted. They work from a little after dawn to near dark, and are thus employed for about three months, the number of almudes picked getting scarcer as the ripened berries are gathered in. These plantations are heavily shaded, indeed doubly so, for the coffee bush, itself affording a dense shade, is further shaded by light guavas or trees the size of a maple. Here in this shade the sopping wet ground is befouled by the multitude of sick each day, and the ripening ova give rise to an infinity of nests of active larvæ into which several days thereafter the same or other workers must tread. The result is that uncinariasis has its great breeding place in the coffee plantations of Porto Rico, and here a barefooted people pollute the soil and are infected and reinfected by it until the life of every man, woman, and child is punctuated by a vast number of reinfections, casual yet common in the nine months of ordinary work, certain and continuous during the coffee harvest when no worker escapes who is without shoes. Therefore it is small wonder, with constantly arriving reinforcements to the little army of parasites that thrive at the expense of the laborer, that we find a sick workingman in the country.

What occurs in the coffee plantation takes place in sugar and tobacco lands, in road making, in fruit culture, and in every occupation which brings the barefooted laborer into wet earth upon which is sowed the seed of the disease, but we are convinced that by far the most heavily infested sections on the Island are those devoted to coffee culture, and that the itinerant laborer who works in the lowlands in the spring and summer and in the coffee plantations in the fall and winter brings from the latter his heavy infections to replenish the uncinariasis that is still sustained in the former, despite the fact that from the nature of the products of the lowlands the sun dries out from time to time nests of larvæ that would otherwise produce a laboring class as infirm as that in the interior.

THE JIBARO.

Our patient has been in times past the "jibaro" and will be in time to come. As we have seen already, while all country districts furnish an incredible number of worm sick, the great breeding places of *Necator americanus* are the coffee plantations, and this is the home of "el palido" (the pale man) of Porto Rico.

The jibaro is a type to be well studied before we essay to interest him in bettering his own condition. Many have written of his virtues.

many of his defects, but few, even in Porto Rico, have seen through the mist of a pandemic the real man beyond.

Coll y Toste says that the origin of the word "jibaro" proceeds from a port in Cuba (Jibara), and that it is composed of two words of Indian origin, "jiba," meaning mountain, and "ero," man. We can not see the necessity of invoking this port of Cuba with the excellently applicable philology he gives us.

Brau says that the term is applied to-day to a laborer, but that its true significance is "a mountain dweller."

Our understanding of the term, as it is applied to-day, is a peasant, a tiller of the soil, a man whose life is not that of the town and who lacks its culture. And when we say that a man is a "jibaro," we put him in a separate and distinct class, a class of country laborers. These people "live now as they lived 100 or 200 years ago, close to the soil." The jibaro is a squatter and does not own the land upon which he builds his modest house, nor does that house cost him anything save the trouble of building it. It is a framework of poles, with walls of the bark of the royal palm (the "yagua"), with roof of the same material or of a tough grass which is used for thatching and with floor of palm boards. Generally the floor is well raised from the ground on posts, and the family is truly a poor and miserable one which is content to have an earthen floor. As a rule, there is but one room for a family, which rarely goes below five, and whose upper limit is measured by the accommodation afforded for sleeping. The cooking is done under a shed on a pile of stones. Weyl says that the house should be valued at about $20.

The food of the jibaro is poor in fats and the proteids are of difficult assimilation, being of vegetable origin, as a rule.

He arises at dawn and takes a cocoanut dipperful of "café puya" (coffee without sugar). Naturally, he never uses milk. With this black coffee he works till about 12, when his wife brings him his breakfast, corresponding to our lunch. This is composed of boiled salt codfish, with oil, and has one of the following vegetables of the island to furnish the carbohydrate element: Banana, platano, ñame, batata, yautia.

At 3 in the afternoon he takes another dipperful of coffee, as he began the day. At dusk he returns to his house and has one single dish, a sort of stew, made of the current vegetables of the island with rice and codfish. At rare intervals he treats himself to pork, of which he is inordinately fond, and on still rarer occasions he visits the town and eats quantities of bread, without butter, of course.

Of all this list of country food there are only three elements that are bought—rice, codfish, and condiments. Rice is imported from the United States and codfish from Nova Scotia. The bread he eats on his visits to town is made of American flour.

This is a normal jibaro diet. With the wage paid him he can get no better, but aside from this he is wedded to cheap bulky foods, chiefly for reasons to be stated, and is completely ignorant of the importance of certain foods which any hygienist would like to add to his bill of fare. If the normal food of the jibaro, as stated, were his usual food, it would not be so serious a matter, nor would the jibaro complain so bitterly of his wretched ration, but the fact is he does not get the menu detailed above save when he can be said to be prosperous. Only a few cents difference in wages will cut out the

small proportion of animal proteids he obtains, the codfish, and a cyclone will drive him in sheer desperation from hunger to the town.

Aside from all this, if wages were better, it is said he would leave his ration as it now is and spend his surplus otherwise. This has not been given, however, a very earnest trial. He takes also more rum than he is given credit for by those who have accepted the formula that the jibaro does not drink, but it is true that he is not usually intemperate in this sense. One of his vices is "la mascaura" (the wad of tobacco), and he believes the juice of the "chaw" beneficial in warding off tetanus.

The jibaro, mountain bred, avoids the town whenever possible, avoids the genteel life of a higher civilization to that of his own. He instinctively tucks his little hut away in the most inaccessible spots; he shrinks from the stranger and lapses into stolid silence when brought face to face with things that are foreign to his life. He does this because he has been made to feel that he must do all that he is told to do by established authority, and he knows that this authority never takes the trouble to look for him unless it expects to get something out of him; because he is suspicious of outsiders, having been too often led astray by false prophets and disappointed by broken promises; because he realizes that he is not a free agent anywhere save in the mountain fastnesses. In other words, he seeks liberty in his home, freedom from the constant repression of those he recognizes as his superiors and exemption from a repetition of deceptions that have been so often practiced upon him. He has always been made to stay strictly in his class, in the "jibaro" class. Frequently when he tries to express himself he is laughed down, frowned down, or growled down. "Tu eres un jibaro" is not a term of reproach exactly, but it means, "You are not in a position to express yourself for you are only a mountaineer. You know nothing of our world; you are still a child. Your place is under the shade of the coffee tree; the mark you bear is clear to everyone; you are a 'jibaro.'" Thus there is a great difference between the jibaro and those who are not jibaros, i. e., those who live in towns or those who command in the country. This distinction is neither made unkindly nor roughly. All the Porto Rican people are kindly and they love their "jibaros," but nevertheless they treat them as though they were children. And the jibaro loyally follows his educated, emancipated fellow citizen, perfectly satisfied to be guided as the latter sees fit.

Much of this guidance is excellent, and it is not our mission to seek to break down barriers which to-day may be needful. The jibaro is respectful and obedient, fearful of the law and never defiant of his superiors; he is generous to a fault, sharing with any wayfarer his last plantain; he is devoted to his family and to his friends. Had he been ill treated by the educated and controlling class in the island he would be sullen and savage, but this has not been the case. If it is true that the jibaro is in many ways differentiated from the upper classes it is equally true that there is no masonry so strong as that existing among the jibaros of Porto Rico. Bound to each other by the most intricate ties of relationship and by a still more potent one, the eternal bond conferred by the title "compadre" or godfather, they share their troubles and shield each other as though they belonged to one great family. It is really wonderful to see how quickly and with what complete self-abnegation an orphaned child or wid-

owed mother is gathered into some poor neighbor's hut and there cared for. For these very same reasons search for a miscreant in the mountains is a formidable undertaking. On inquiry no one knows him, never saw him, never even heard of him, and the closest scrutiny of their faces will not detect the faintest trace of interest or even of intelligence.

Care must be taken in deducing facts from questioning a group of jibaros even in the most unimportant matters. They are tremendously suspicious and generally let someone amongst them who is "leido" (one who has established a local reputation for worldly wisdom) speak for them. One can be pretty sure that the rest will say "amen" to all of his remarks. It is said that this deep suspicion of a strange investigator proceeds from the methods employed by the Spanish "guardia civil," or rural guard, to run down those suspected of unfaithfulness to the administration, petty infringement of law, etc.

The jibaro is equally superstitious and very quickly impressed by a supernatural explanation of any phenomena he can not understand. The more outlandish the explanation of a disease the better he likes it, and for this reason the "curandero" or local charlatan is so popular and powerful in the mountains. We very much fear that our abrupt tumbling in the dust of ancient explanations of his anemia, our assertion that it was due to "worms" and our administration of "strong medicine" which practically put him hors de combat for the day, accounts for part of our early success. In spite of this lack of knowledge of the world above him he has one quality which is his ever ready defense, his astuteness. There is one phrase much used in describing the jibaro's acuteness of observation. Referring to a trade it is said: "Para un jibaro, otro, y para los dos, el demonio," which means, "To get the best of a jibaro, employ another, and to catch both, Satan himself must take charge of them."

This astuteness, despite all of the great obstacles in the path of our work among them, was what chiefly led to success in bringing these people under treatment. They soon saw that we got results, and with a fact capable of sensational proof in our hands, the jibaro accepted us and we joined the "order" to which we have made reference. From that time he has been our friend, and better friends no man ever had, for his entire support is given us; he preaches our "new medicine" and wherever we have expounded these things to him by word of mouth and by virtue of proof he takes pride in explaining, better than any representative of the upper classes, how the disease is acquired and how it may be prevented.

The prime fact, however, is that he has, until recently, been much neglected, neglected by those who are not of his class, neglected by the authorities. There are municipalities whose town forms but a tenth of the population of the outlying country, whose taxes are collected to support it, yet which seem to forget the submerged mass in the mountains. This being so for the towns which are surrounded by these people, how attenuated the interest becomes in the capital and larger cities of the island and how extremely dilute that of the continental American who neither knows his needs nor even what "jibaro" means.

Education will transform this jibaro into something much better or much worse, for he will not remain content as he is when he can

read, write, and see the world with his own eyes. In this education the respect he bears his more fortunate compatriots, the power for good they have over him, and the confidence he reposes in them must be preserved. The labor he must perform to enrich the island must be dignified by his employer and by himself, or else the hills will be deserted and the "jibaro" will become a vicious hanger-on of towns. Better homes, better means of communication with towns, now becoming an accomplished fact, better food, education, in which remarkable progress is being made at this day, better habits of life, especially those relating to the modern prevention of disease, must form a part of any plan adopted to improve his condition. The planter who to-day sees only the laborer must see in him the man whose bodily, mental, and moral development will make the plantation a success. The planter is the man of all men in Porto Rico who must begin to help the jibaro upward in order to emerge from his own present industrial depression.

This lack of mental contact, of a common ground of interest between the jibaro and the better class of Porto Ricans drives the former to charlatans for his medical advice, to the wild fruits and vegetables of the interior for his food, and to weird creeds for his religious comfort.

His dependency causes him to look for protection, for direction, and for ideas from planter, from municipality, and from insular government. He considers himself a ward of his employer and of those placed in authority over him. He does not care to accept any responsibility for the simple reason that he has always been made to feel that he is not a responsible person. Therefore, how can we blame him when we find him without shoes, knowing that by wearing them he will protect himself against a dangerous infirmity; without bacon and corn; without household furniture; with but one room for his entire family.

It is a specious excuse, nothing more nor less, which avers that a jibaro is born the way he is and can not be changed at this late day, that we must await a new generation, etc. On that principle we could expect very little from the antituberculosis crusades in New York. The truth is that to change the jibaro we must convince him that he will be bettered by the change, and he is sharp enough to change then, but the gist of all is that these changes must be begun by the men to whom the jibaro has always looked for light, and this means good hard work and much perseverance, tact, and genuine personal interest. From our acquaintance with the men to whom this burden will fall we should say that they are not only sufficiently good business men to realize the benefit they would get out of a healthy laboring class, but that the innate patriotism of the Porto Rican agriculturist and the deeper underlying sympathy for his jibaro will some day bring about reforms that they alone can make possible.

THE PLANTER.

The social status of the man is that of a country gentleman, generally speaking. With some exceptions, he is by no means a "farmer" in the slangy acceptance of the term. He and his family are frequently people who have traveled much in their own and in foreign

countries. Very hospitable and good livers whenever their means permit, they are most enjoyable companions and contrast remarkably with the isolation in which they live.

These gentlemen are struggling hard against adversity at the present writing. They have passed through the darkest days of their industry (1899 to 1904) with wonderful fortitude, and have suffered untold trials which were all the more acute when one recollects that in the days before the war they were well to do and could afford luxury. The present low price of coffee permits a fair margin of profit, but this profit now is so small as to be greatly affected by needless expense and actual waste which heretofore did not prevent a handsome end result. The matter of transportation to the coast has assumed serious proportions. While the American administration has built miles upon miles of roads opening up the interior, and has thus immensely improved facilities for transportation, it is still far too expensive to get coffee over the trails to the shipping port. One planter stated to us that it cost $1.40 per hundredweight to reach the coast by pack animals, the carrying limit of which is 200 pounds, when by wagon road it would be about 25 cents.

Another obstacle to his success is his failure to improve his methods of coffee growing. Agricultural experts assure us that his output is far less than it should be were the labor more intelligently directed.

But the heaviest load he has to carry is the infirmity of his laborers, their almost universal anemia, and the ignorance of the class of labor upon which he has to depend.

Agricultural laborers, in spite of the small wage they receive, are nearly if not quite as expensive as those in the United States, for with 50 per cent less of efficiency from disease and wasteful methods of work, the difference in wage is of small advantage. Weyl states:

> The small equity which the planter holds in the estate which he cultivates does not permit him to pay any higher wages, and the poverty of the planter prevents him from making the outlay necessary for the proper cultivation of his land.

Few coffee planters have anywhere near a reasonable amount of their land under cultivation for the reason that with the poor help and methods now existent they are unable to extend their plant. The regular labor, employed all the year round, the peons who form a relatively small percentage of the entire number available for work, are paid for a full day's work, and their degree of anemia is such as to prevent their doing but about 50 per cent of what they are paid for doing. Our estimate of the relative efficiency of labor was made from what the planter himself told us and by a simple expedient which we tried upon about 500 adult workers in different parts of the interior. We questioned each one as to the amount he could pick in a day, and found that from two to three almudes was the utmost the majority could do, and that one almud was too much for many. Some stated that after picking a sack full in a remote part of the plantation they were unable to get it in to the mill without a mule, on account of the fact that their limbs refused to bear them up. When these people were working at light work, and at a time when the more they picked the greater the profit to themselves, is it reasonable to suppose that when working for a wage without this incentive this 50 or 60 per cent labor would be any more efficient?

This reduction in laboring capacity demonstrates what a heavy toll is paid by both employer and employee to uncinariasis in Porto Rico.

As to absentee landlords, Weyl states:

> Many of the absentee owners of Porto Rican properties and many of their agents in Porto Rico consider the island and its population as equally fit for the crassest exploitation, and are as contemptuous of the people as they are enthusiastic about the island. The current use by many Americans of an opprobrious epithet for Porto Ricans bespeaks an attitude which takes no account of the human phase of the problem, but considers the population as composed merely of so many laborers willing to work for such and such a price.

Thus the poor laborer, his earning capacity cut down by his disease, with employment which is at best very irregular, with his sick wife and children for whom he has to buy "iron tonics" that cost all that he can rake and scrape together, without money for clothes, much less for shoes, with a palm-bark hut not too well protected against the damp cold of the grove in which he lives, with not a scrap of furniture save, perhaps, a hammock, and, worst of all, with a miserable diet lacking in proteids and fats, lives from day to day, saving nothing, knowing nothing of the world beyond his plantation, working mechanically simply because he is not the drone he has been too frequently painted outside of Porto Rico, but without any object save to keep on living as generations have done before him. It has been our experience that when he is asked "Why have you sought our dispensary?" the answer has almost invariably been, "Because I can no longer work." This jibaro, nevertheless, has ever been the lever which has raised the bank account of Porto Rico, and with an average of 40 per cent of hemoglobin and two and a half millions of red corpuscles per cubic millimeter he has labored from sun to sun in the coffee plantation of the mountains, in the sugar estate of the coast land, and in the tobacco fields of the foothills in addition to his personal cooperation in other industries and commercial enterprises. He is a sick man and deserves our highest respect and merits our most careful attention as a vital element in the economic life of the island. The American people should take seriously into account his future, which is at present anything but promising.

THE HEALTH SERVICE.

The health service of Porto Rico is superintended but not administered by a bureau of health in a department of health, charities, and corrections. The chief of this department is a layman and a member of the upper house of the legislature. The health service of the towns is practically independent of the bureau of health. The municipal physicians are appointed by the mayor of the town and paid by the municipality, hence they feel and are made to feel that they owe their allegiance to these towns.

The bureau of health consolidates the vital statistics and reports annually upon health conditions throughout the island. Through their two inspectors this bureau is supposed to keep in touch with the conditions of sanitation in each town and direct health officers in the performance of their duties. From time to time the board of health is convoked to recommend sanitary laws that become necessary, to decide questions arising over plans for drainage, sewerage, waterworks, etc.; grants for industries affecting the public health; and, in

general, to act as an advisory body to the executive branches of the Government in all that pertains to public health. The bureau of health is empowered to prosecute offenders against the sanitary laws in vogue.

As a matter of fact, however, there is no codification of such laws. In the report of the governor for 1908 we find the following:

> The law as it is at present is a combination of old military orders, ordinances approved by the executive council, and local ordinances passed by the municipal councils, and there is much doubt as to the responsibilities of the insular and local authorities.

The relation between the health officer of the town and the director of health for the island is a truly unhappy one. His natural chief, the director of health, may "direct" him to perform some duty in the interest of sanitation, but the mayor may not support him, and in the end the work will not be done. This clash between the alcalde's supervision of local health matters and that of the bureau of health almost always results in defeat for the bureau, for there is one argument of a municipal government that brings all discussion to an end, i. e., the lack of funds with which to carry out "recommendations" and "instructions" of the chief in San Juan. Of all the official documents on the state of affairs we have attempted to describe, nothing is so true nor so well expressed as that found in the report of the director of health for the fiscal year ending June 30, 1908:

> Unfortunately there are two diametrically opposite tendencies in our legislative bodies; the one, zealous for the defense of the autonomic principles, aims at absolutely decentralizing all questions of health to such a point as to even have the appointment of the medical inspectors of health depend directly upon the popular vote; the other one endeavors to centralize all health matters.
>
> It is therefore impossible to reach a satisfactory solution, and, indeed, a long time will elapse before the passage of such an important bill can be effected.
>
> And during that long period of time the public-health service will go as it has gone up to the present, and all the efforts of the bureau of health will be utterly useless against the indifference of the ones, the political influence of the others, and, above all, against the inevitable clash between the public and the private interests.
>
> Without a health law, without health regulations, the bureau of health fights its way, and the instructions it gives are disregarded and even slighted, and the denunciations it makes before the courts have no penal sanction whatever, for judges can not condemn when no law obliges them to do so.
>
> As a consequence of such a state of things, the sanitary conditions of the island are quite unsatisfactory, the death rate is much higher than what it ought to be, especially as far as the infant mortality is concerned, and hygiene in the vast majority of the towns is deplorable.
>
> On the other hand, the sum appropriated for the bureau of health and charities amounts to $26,940; but this appropriation is made only for the purpose of paying the salaries of the personnel of the bureau.
>
> Nothing has been appropriated, not a cent, for the purpose of meeting an unfortunate eventuality, an epidemic, an urgent work of sanitation, and were it not for the good will and earnest desire that the honorable the Governor of Porto Rico has always shown to attend to such contingencies it would be impossible to remedy them. * * *
>
> The municipalities are not more generous. Aspiring to administer and conduct the health and charities service of the island, they hardly appropriate a meager sum for the object of covering the expenses of such service.

All save one of the ten annual reports of the governors of Porto Rico bears some reference to this state of affairs, and in the last three there has been very vigorous complaint made of the lack of an efficient organization of the health service.

The chief difficulties have been that medical officers are constantly blocked in the performance of their duties by laymen who, though often well meaning, have no title to the administration of sanitary affairs and who control the health service, both the so-called central organization and the local service in towns. The other difficulty proceeds from the first; the funds for such a service are utterly inadequate. The service not being autonomous, and shorn of its powers and responsibilities, funds are not provided by those who, realizing the inherent weakness of a disorganized service, are unwilling to put money into it, even though they be cognizant of the necessity for more ample expenditures, which they all too often are not. Until the people, not only of Porto Rico, but of the United States in its relation with Porto Rico, thoroughly understand that medical work must be done by medical men; that medical men are just as fit to administer the affairs of their profession as any other good citizen, placing themselves, of course, under the scrutiny of the constituted head of the Government, the island will be to a large extent deprived of the valuable services of those whose mission it is not only to save life but to retain health.

On the other hand, the local health service has its special difficulties. Most towns have but one physician. The lawful duties of this physician, who is also the medical officer of the town, are almost beyond credence:

(1) He is obliged to treat all indigent sick. These proceed from a class which form at least 90 per cent of the total population of the municipality. The worst of it is that they live in the country, generally accessible only over steep trails. The alcalde can insist upon his attending them personally and this takes the doctor away from the only private practice he has, that of the town, for a physician's visit to the isolated huts of the poor in the mountains is a day's undertaking. Besides, the town in the meanwhile is deprived of the services of a physician, and his legitimate duties as health officer suffer.

(2) He is charged with the care of the municipal hospital.

(3) He must treat the insular police and their families and render service to all wounded in any official or private enterprise, such as road building, etc. He must operate upon and treat such wounded and make such autopsies as he may be ordered to perform by proper authority, as well as to give testimony in a court of law on any case brought to such court.

(4) He is health officer, responsible to the alcalde (mayor) that nominated him, and to the bureau of health. The latter gives him regulations governing the inspection of meat, bread, milk, and articles of food, in general offered for retail; inspection of beef and pork before and after killing at the slaughterhouses; inspection of corrals, stables, pens; physical examination of butchers, breadmakers, cigarmakers, etc., with the preparation of the certificate in each case and a record of same in the official books. The alcalde, often ignorant of the danger from the slighting of any of these duties of a sanitary officer, and feeling that he, the alcalde, is the responsible official, deprecates at times a strict enforcement of the law, at times exacts unnecessary duties of his doctor, to the detriment of the service and the great weakening of the efficiency of the medical officer. If, however, there is an epidemic the medical officer is held strictly

accountable, and all of these responsibilities assumed by the alcalde are transferred with lightning rapidity to the unfortunate "doctor," who has to bear the opprobrium of the community in which he lives. If, finally, the medical officer at any time becomes persona non grata to the alcalde, the latter can and does remove him, without the slightest compunction, for any trivial omission of the multitudinous duties the law requires of him. In those rare cases where an appeal is carried to the governor and the physician is exonerated and reinstated the latter is unable usually to tolerate his position very long. On the other hand, the alcalde may have a medical officer who is not doing his duty, but no one else can be obtained to take his place, and much poor service must be endured for that sole reason. Were there a true medical service in the island a medical chief could oblige him to perform those duties acceptably with far more moral force than a layman whose interpretation of what is medically necessary is not respected by a technical man.

With these fragile threads linking the bureau of health to the communities over which some efficient control should be, but is not, exercised; with an insufficient, illy administered local service, the gap between the jibaro and all that the medical officer of the town on which he depends should represent is well-nigh impossible to bridge. Save grave necessities, to which no humane physician would fail to respond, the jibaro is isolated from the doctor.

Unless he goes to the town for treatment he can expect nothing, and when he goes there he has to look up the doctor for a prescription, the alcalde to O. K. it, and the town pharmacist to fill it, and the chances of accomplishing a happy combination of all three are not always good. All too frequently, when his O. K'd prescription is presented at the municipal pharmacy he is informed that the appropriation for medicine for the poor is exhausted. Thus he falls an easy prey to "medicine men," charlatans, patent cure-alls, and local "curanderas," or old women who pose as medical oracles and whose ignorance is only exceeded by their temerity. The jibaro does not prefer those people, as has been so often said. The proof of this is that he swarmed to our clinic over many a weary trail because he had faith in "la ciencia," as he always calls it, and left his false prophets behind him; but the real state of affairs is that he is usually driven to them from necessity.

If all this is true of the actual treatment of disease, what shall we say of the preaching of preventive medicine to the country people? This is a field untouched save by the physicians charged with the anemia dispensaries. Our experience is that this is the most promising work that presents itself to the sanitarian, for the jibaro will not only listen, he will take heed, he will become interested. This is the only path to hygienic reform. Without creating a popular interest in such reforms laws will only mock our best endeavors to enforce a regimen which would be conceived by even the poor and dependent jibaro, accustomed to obey, an infringement upon his personal rights and another burden government had chosen to foist upon him.

STATISTICS.

Returns of births are not to be depended upon in Porto Rico. The excellent law of registration is not enforced, although of late years there has been less negligence than before.

With regard to deaths the number is correct, but very little dependence should be placed upon the causes to which deaths are attributed. This is very easily understood. Most sick who die in the island are not seen in life by a physician. They die in the country and from a more or less fragmentary account of the illness given by the relatives or friends the municipal physician guesses at the cause of death. On presentation of the physician's certificate, a certificate of registry is given by the municipal judge, without which burial is against the law; hence the total number of deaths is fairly correct. Unfortunately the municipal physician is not always the one who makes this unsatisfactory diagnosis, nor even the judge, but the practicante of the one or the clerk of the other. The most satisfactory of all of these diagnoses is that of "anemia," as it is the most common and best known of the diseases of Porto Rico. Any deaths erroneously attributed to "anemia" are more than compensated for by the deaths from "dysentery," "heart disease," "malaria," etc., many of which are deaths from uncinariasis.

The unreliability of vital statistics in Porto Rico has been frequently commented upon, but we would especially call attention to the report of the superior board of health for the period of military government (Oct. 18, 1898, to Apr. 30, 1900), page 82, and to the report of the director of health and charities for the fiscal year ending June 30, 1907, who says:

> The statistical work as it is done in Porto Rico is very defective. In other words, such work does not exist at all in Porto Rico, and all the statistics that have been presented up to the present time, or that may hereafter be presented, are illusory; they are not the exact representation of the whole truth.
>
> Various are the causes giving origin to such state of things. The municipal registries are not kept as properly as they should be, the data therefrom comes always late, and it is almost always deficient. Moreover, taking into account the dissemination of the rural population in Porto Rico, the vital statistics are always inexact, as the country people, in their large majority, lack the assistance of a physician, and the cause of the disease determining a fatal case is most of the time unknown, resulting therefrom that the certificate issued by the doctor is erroneous in the majority of cases.

With these facts staring us in the face we can not discuss the vital statistics of the island save in so far as they relate to the actual number of deaths and in a general way as reflecting the prevalence of certain diseases. The most practical way to fathom the course of events in the last 15 years is to consider the deaths by 5-year periods:

(1) The number of deaths for the last five years of Spanish rule was 130,207, with an annual death rate of 28.9 per 1,000. Three thousand and sixty-two of these deaths were due to smallpox and yellow fever.

(2) The number of deaths for the first five years of American government was 159,312, with an annual death rate of 33.48 per 1,000.

(3) The number of deaths for the second five years of our government of the island was 120,595, with an annual death rate of 23.33.

This brings us to June 30, 1908. The first year of the third five-year period just beginning, 1908–9, gives a death rate of 20.90 per 1,000, the lowest rate so far recorded.

There were no deaths from yellow fever after the American occupation and practically none from smallpox. The first-named disease has been wiped from the list of Porto Rican plagues by our quaran-

tine service and the second by the work of the Army, which in the days of the military government vaccinated practically the entire population.

There were several factors which throw light upon the great increase in mortality during the first five years of American administration:

(1) The economic crisis incident upon the war of 1898 and fall in the price of coffee already discussed.

(2) The ruin of the coffee plantations by the hurricane of 1899. These two catastrophes deprived the jibaro of the only work he had.

(3) Thus insufficiently clothed, out of work, with nothing saved up, and already sick from repeated infections in previous years, the jibaro was thrown out into the mud, without shelter, without money to buy rice and codfish, and deprived of the fruits and vegetables for which he used to pay nothing. While both 1898 and 1899 were marked by much rain, the months following the hurricane period were especially wet. The sterilizing effect of sunlight and drying upon millions of polluted spots being withdrawn, the water-soaked earth made a perfect culture ground for ova of uncinaria, and into these nests plunged the barefooted. With the infectivity of the soil thus intensified, with the jibaro, poorer than ever, closer than ever to the earth, can we wonder why anemia, responsible for 22.13 per cent of the total deaths in 1898, became responsible for 30 per cent and over after the hurricane? Can we feel surprised at a death rate of 57, 58, and 49 per 1,000 per annum in the months of October, November, and December, respectively? Is it unreasonable, after the prevalent conceptions of the cause of Porto Rican anemia so firmly rooted in all the island, that of 11,885 deaths from that disease of a total of 35,781 in the fiscal year 1901, not a death was attributed to uncinarial anemia?

The beginning of the second five-year period under American administration corresponds with the birth of the campaign against uncinariasis undertaken by the Porto Rican Anemia Commission and carried up to the present day by a service to which it gave life. When we reflect that, save smallpox and yellow fever, no other morbific factor save uncinariasis has decreased in those five years it is only just to conclude that the fall in mortality from 42 per 1,000 in 1899–1900 to 20.90 per 1,000 in the fiscal year 1910 is due to two great advances in the life of the island; one, the improvement—steady, difficult, but certain—in the economic status of the laborer; the other, the medical service, which dealt the staggering blow administered to her great industrial plague, anemia. To separate these two would be impossible, so interdependent are they; to claim all for one or the other would be ridiculous; but the real significance of their close, their inextricable union is the self-evident fact that anemia in Porto Rico is a medico-socio-economic problem which can not be solved without her physicians. Once solved she will enter upon an era of prosperity which to-day our most extravagant dreams can not foreshadow.

HISTORY OF A 10 YEARS' CAMPAIGN AGAINST UNCINARIASIS IN PORTO RICO.

Anemia Previous to November 24, 1899.

We have abundant evidence to show that anemia was a very prevalent disease in Porto Rico throughout the entire nineteenth century and a potent cause of death. Fray Iñigo Abbad, writing in 1788, states that the jibaros "lacked liveliness and had the color and aspect of convalescents." This he attributed in part to the abuse of coffee. He also discourses at length upon the subject of fevers in the island, which he states were very prevalent, and adds: "Those that escaped the fevers died of dropsy."

Del Valle's study of the jibaro was the most conscientious work we have read. Some of his statements are as follows:

> Porto Rico is an exception to rule that the health and vitality of country dwellers is superior to that found in persons living in cities.
>
> As nearly all jibaros are anemic, it is only the exception to see one of good ruddy color * * *. Their natural hue is dead white, yellow, or greenish yellow. The negroes and mestizos, who are sick, are of an ashen gray.

He adds, however, that it is unusual to see a negro sick of anemia.

> We also call attention to the poor clothing of the jibaro, which lacks, among other things, such luxuries as shoes, which would preserve him from the humidity of the soil.

He says that men, women, and children after labor in a coffee plantation return to their houses "with aspect more of patients than of laborers."

> On account of the influences to which we have referred the jibaro's appearance is that of a convalescent. So true is this that, if we can not say it of all, we can say it in a general way, our white man is a sick man.

This was written in 1883, and in those days the anemia of Porto Rico was attributed to the climate, insufficient and improper food, unsanitary habits of life, and malaria. Medical authorities emphasized the latter as the determining cause, but the general public considered the character of the food and lack of hygiene as the real underlying bases for their anemic laboring class.

During the period 1890 to 1897 the mortality from anemia ran gradually from 13 to 15.5 per cent of the total mortality. In 1898 it reached 22.13 per cent. On August 8, 1899, the hurricane of San Ciriaco made its appearance.

> The storm left the people without shelter and without food, or but little of either. The only shelter hundreds had—for in the interior all the cabins of the poor were destroyed—was such as could be secured under spreading trees, where they lived for weeks, sleeping on the wet ground. All the fruits of the country, on which they depended to a great extent, were thrown to the ground, but were usable for about six weeks. The misery of people without shelter and deprived of their accustomed food was beyond description. To make matters worse, the municipal governments were almost wholly disorganized and rendered incapable of extending any aid to the miserable people. (Report of the Hurricane, Military Government of Porto Rico.)

This hurricane came at a most unfortunate time, as will be seen from what has gone before. A promising coffee crop valued at $7,500,000 was rapidly reaching maturity when in a trice it was swept out of existence and the farms which produced it were damaged to one-half their value. Bananas and plantains, which form one-half of the food value of the jibaro's ration, and the very part he does not have to buy, "were practically all destroyed to the roots on August 8."

The governor general, writing to the adjutant general of the Army, says, under date of August 17, 1899:

> The appearance of the surface of the country now very closely resembles a northern region that has been swept by fire, for everything is brown and lifeless.

The Army took brisk hold of this situation and issued rations to the value of $831,480. With marvelous ability and the same thoroughness which characterized his founding of the superior board of health of the island and the vaccination of 800,000 Porto Ricans, Col. John Van Rensselaer Hoff, of the Army Medical Corps, established a splendid system of aid to starving people on the principle enunciated by himself:

> No person shall die of starvation, and no able-bodied man shall eat the bread of idleness.

Thus were the lives of untold thousands preserved and the gratitude of the Porto Rican people honestly earned.

In this hurricane 2,780 were known to have died as a direct result of the storm itself, generally by drowning, and 500 more were never heard from. In Jayuya whole coffee plantations slipped down the mountains into the rivers.

In the wake of this storm came a period of rain, which was unusually prolonged and violent; everything was wet and muddy for weeks.

Dr. Ashford, who was in Ponce at this time, a city which had suffered severely both from storm and flood, received an order from the general commanding on the 26th of August, 1899, to establish a field provisional hospital for the purpose of accommodating at least some of the thousands of sick jibaros who were thronging the streets of the city.

All went well until he attempted to feed up what he considered as anemics from malnutrition. He very soon found that they did not care for meat and other concentrated foods, but demanded their bulky diet of the hills. Moreover, the diet of a healthy American soldier made them sick with diarrhea, and they began to leave camp. He states, under date of September 13:

> The explanation of this inaptitude for our cooking is believed to be also due to the fact that many eat little more than dried codfish and a small number of bananas at any time, and that they were in a meat-starved condition when admitted. This is further borne out by the fact that fully three-fourths of the patients are suffering from grave anemia due to this poor diet, and together with this cause bad sanitation, but chiefly from the bad quality of food to which they are accustomed. * * *
>
> The cases are many of them chronic. * * * These chronic cases are among those most desperately in need. Pernicious anemia, malarial cachexia, diseases of the heart, lungs, and kidneys are the prevalent diseases.

From this time on great care was exercised to give these people an abundant diet. He had a ration of 60 cents a day at his disposal, and no pains was spent in coaxing and compelling a rational diet. In

this he was successful, for with a Spanish cook the food was made more palatable and the diarrhea subsided, as did the complaints of the barbarous food of the "Americanos," but not one whit more color came into their faces, and the daily death toll was about the same as it had been at first.

THE IDENTIFICATION OF THE CAUSE OF PORTO RICAN ANEMIA.

After over two months' examination of many patients and much speculation, it became evident that these chronic sick, the anemics of many years, not of a few months, were all suffering from a common malady; that they presented a picture identical with that Dr. Ashford had observed in the country people in various parts of the island previous to the cyclone; that gastric dyspepsia, heart lesions, œdema, extreme pallor, and debility did not stand for separate diseases, according to the prominence of one or the other set of phenomena, but were part and parcel of a clinical entity; that this protean array of symptoms had one definite cause and was not dependent upon a series of predisposing accidents of environment, concomitant disease, or mere poverty and bad hygiene. The suspicion became more fixed when good and abundant food throughout two or three months had utterly failed to influence their condition. At first his attention was directed to the blood in a search for the cause. Malaria was thus excluded, but on a differential count of the leucocytes a decided and rather general eosinophilia was noticed. Remembering that recent investigations of the blood of sufferers from trichiniasis had unearthed a high eosinophilia, and realizing that the habits of these people would expose them to a general infestation by animal parasites, the feces were searched; ova were found which tallied with those of *Ankylostomum duodenale*, pictured in Manson's first edition of Tropical Diseases, and thymol was administered to a typical case. With the recovery of the worms the cause of the anemia of Porto Rico was demonstrated. Thinking that the parasite found was the Old World species, the only one up to that time described, he sent the following telegram:

PONCE, *November 24, 1899.*

CHIEF SURGEON, *San Juan:*

Have this day proven the cause of many pernicious, progressive anemias of this island to be due to *Ankylostomum duodenale.*

ASHFORD.

This announcement was followed by instructions to Dr. Ashford from the chief surgeon to aid the superior board of health in preparing a pamphlet on the subject. This little work, entitled, "Anemia, Its Causes, Treatment, and Prevention," was issued by the board in 1900 and distributed among all physicians and pharmacists throughout the island. It contained copies of the illustrations in Manson's work and was published in English and Spanish.

In addition to this work, Dr. Ashford wrote an article on 19 special study cases in Ponce which was sent the Surgeon General of the Army, by whom its re-publication was authorized in the New York Medical Journal April 14, 1900, under the title, "Ankylostomiasis in Puerto Rico."

Returning to the United States in December, 1899, Dr. Ashford carried some of these worms to Washington, where he called upon

Dr. Charles Wardell Stiles for the purpose of giving them to him. As Dr. Stiles was not in Washington at the time, they were examined by his assistant, Dr. Albert Hassall, who, after a cursory glance at a female, remarked that the ova were unusually large for *Ankylostomum duodenale*, and recommended more careful study of them zoologically, but Dr. Ashford, not being a zoologist, left his specimens in Washington and made no further study of the worm he had found in Porto Rico.

Stiles, in 1902, working with Ashford's specimen of hookworms from Porto Rico, and with others from the United States found subsequently, announced that zoologically the parasites belonged to a new species, *Uncinaria americana*, although later he changed the name to that which now obtains, *Necator americanus*. The new species, interesting from a zoologic standpoint, although the mode of infection, symptomatology, morbid anatomy, treatment,[1] and prophylaxis of the disease caused by the Old-World and the New-World worms are, so far as we know, precisely similar, became of tremendous importance when Dr. Stiles demonstrated that uncinariasis was crippling the South just as Dr. Ashford had shown it to be the industrial curse of Porto Rico.

Through the pamphlet issued by the superior board of health in 1900 and the simultaneous appearance of Ashford's article in the New York Medical Journal, physicians in Porto Rico and in the United States were advised of the presence of hookworm in the island and of its tremendous power for evil, but neither here nor on the continent was any especial interest aroused, save in the few who later on have taken an active part in subsequent campaigns against its ravages.

Despite the pamphlet of the board of health averring that anemia was the scourge of Porto Rico, "killing at least 1,000 persons each month" and warning the practitioner to be "constantly on the outlook in all cases of anemia for this parasite," etc.; despite the republication of Ashford's American article in the report of the superior board of health for the period of military government, with a corroboration of its importance by Lieut. F. F. Russell, of the Army, in 1900, who found the ova in 54 per cent of the inmates of the boys' charity school in San Juan; despite the repetition of the announcement by the succeeding board of health under the new civil government that anemia here was due to an intestinal parasite, *Ankylostomum duodenale*, no active measures were taken for its study nor for its control. This is not to say, however, that it aroused no interest among a few medical men in Porto Rico, but there was no general interest manifested, even by the Government at that time.

Feeling sure that a work undertaken to convince the island of the significance of a disease which accounted for over 30 per cent of the total high mortality at that time would have far-reaching consequences, and realizing that this death rate would go on until some one would make a sufficiently strong demonstration of the possibility of its eradication to awaken both Porto Ricans and Americans in the insular government to action, Dr. Ashford expressed his earnest desire to return to the island.

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[1] Male fern, which has so powerful an effect upon anchylostoma duodenale, does not appear to act so effectively upon *necator americanus*.

In January, 1902, after a careful survey of the literature of this disease in the Surgeon General's library, he was again ordered to Porto Rico, and there met Dr. Walter W. King, of the United States Public Health and Marine-Hospital Service, who agreed to take part with Dr. Ashford in a study of such a number of cases as would bring the matter clearly to a head and compel attention not only from the profession, but from the insular government. Throughout 1902 and part of 1903 a series of 100 cases were carefully followed, blood counts made, and treatment detailed. They were ceded for this purpose two wards in the large Tricoche Hospital of Ponce, and every possible opportunity was afforded them by the director and his assistants to complete their labor with success.

The report of these 100 cases was published in American Medicine, September 5 and 12, 1903. In this article the following appears:

Whatever the attitude of the local practitioner may be, it is a fact that the importance of uncinariasis is not being realized, and that the proper efforts are not being made to cure and stamp out this disease. We appeal for a thoughtful and sensible view of what is now the great scourge of the agricultural classes in Porto Rico, and what has come to be a most important economic question in the betterment of the island.

The editor, Dr. Gould, was not only good enough to permit this lengthy article to run through two numbers of his periodical, a signal courtesy, as it was contrary to his rule that an article be accepted for publication which could not be terminated in the issue in which it was begun, but he wrote a stirring appeal, which accompanied our thesis, to arouse the medical men of the island and the government of Porto Rico to a realization of their grave responsibility.

One month later Drs. Ashford and King addressed a letter to the president of the superior board of health of Porto Rico, furnishing him with extracts from many European authorities on ankylostomiasis and urging:

(1) To thoroughly circulate the literature on the subject.

(2) To take some part of the island, as Utuado or Adjuntas, where "starvation, misery," etc., is reported; establish a tent hospital; place two well-instructed doctors, who are enthusiastic, energetic, and diplomatic in charge; let them have the nurses, medicines, cots, and food for the running of the station; and let them go into the highways and byways and seek them out, cure as many outpatients as possible, and take the miserable poor into the tents.

After six months publish results, see if the death rate from these centers of uncinariasis does not materially decline, and, above all, let us see how much "starvation, misery" and so forth is the fault of *Uncinaria americana* and how much is due to real lack of food. * * *

Such an experimental station, if conducted by Porto Rican physicians, modern young men, men who will be painstaking, and who will understand that upon them lies a heavy responsibility; that they are there to fight down a shockingly high anemia mortality; such a station, we repeat, may cast its helpful light down the future years of their island and have far-reaching influences for which we do not dare yet to even hope.

(3) To encourage the other means of prevention heretofore noted, especially in estates of sugar, tobacco, and coffee. * * * It is not deemed wise, nor well, to seek legislative restriction at present on soil pollution. Let example and pamphlet teaching do its best. Let us convince the people and enlist them in their own interests to combat the disease, and the rest will follow naturally.

In December, 1903, Dr. Ashford addressed the Porto Rican Medical Association on "Anemia in Porto Rico" at their annual meeting. The address consumed the best part of two afternoons, and every phase of the matter was taken up. A strong appeal was made that

the medical men of the island urge upon the Government that some action be taken to combat the existent conditions. The paper aroused much discussion, and was defended by Dr. Augustin Stahl, the oldest member and a lifelong scientist. A committee was appointed to prepare a critical review of it, and in April reported, confirmatory as to the essential features and noncommittal on some minor points. Thus we had knocked upon all the doors and could only await results.

After four years and more of incessant clamor for recognition of the true cause of Porto Rican anemia, it became evident that we were not to be again disappointed.

Hon. William H. Hunt, then Governor of Porto Rico, and Hon. Regis H. Post, at that time auditor of Porto Rico, had become deeply interested, and fully appreciated the great economic importance of the disease in the island. The Governor, in his message to the legislative assembly, January, 1904, specially called attention to the necessity of beginning an active campaign against the disease.

A bill providing for the formation of a commission for the study and treatment of anemia, and carrying with it an appropriation of $5,000, was introduced by Mr. Post, passed by the assembly, and approved February 16, 1904, by the Governor.

Gov. Hunt named the following as members of the commission: Capt. Bailey K. Ashford, assistant surgeon, United States Army; Passed Asst. Surg. W. W. King, Public Health and Marine-Hospital Service; Dr. Pedro Gutierrez Igaravidez, health officer of Bayamon, P. R.

In addition to his duties as member of the commission, Dr. Gutierrez acted as its disbursing officer.

At the request of Gov. Hunt, the Secretary of War and the Secretary of the Treasury authorized Drs. Ashford and King to engage in this work. At no time was any payment made to them by the insular Government for their services, but, in consideration for the loss to his private practice, Dr. Gutierrez received $150 monthly.

This marks the first era in the work against " hookworm " in Porto Rico, and was the first demonstration of its endemic presence on American soil, an endemic now so painfully evident in the South of the United States.

The following is quoted from A Summary of a Ten Years' Campaign Against Hookworm Disease in Porto Rico, by Ashford and Gutierrez (Journal of the American Medical Association, May 28, 1910, Vol. LIV, pp. 1757–1761):

SYSTEMATIC WORK BEGUN.

We began with only a handful of friends. The press thought it strange that hunger should be "discovered" to be due to a parasite, and based its incredulity on serious economic crises, through which the island was passing. The well-informed and moderately well-informed people, whose circumstances protected them against the disease, as they were well shod, reasoned that as they were well fed they were perfectly protected against this "hunger-producing parasite," in contradistinction to the afflicted pale ones, who were desperately poor and had to live on bananas alone. In short, we had a difficult situation to meet. Had it not been for one saving clause we would have failed. That element was the poor man himself. He was so utterly miserable that he could not be more so, and as he had faithfully embraced each and all promises to cure him of what he persistently called his "enfermedad" (illness), in spite of the

THE MORNING CLINIC OUTSIDE THE DISPENSARY, UTUADO, 1904.

Waiting their turn.

more refined explanation of his better educated compatriots, he gingerly accepted our treatment.

The moment we opened our hospital the sick began to arrive. We had told the Governor we might treat 600 cases, but when considerably more than 600 had been treated in Bayamon in less than one month, and a cured patient began to deposit his entire family and that of his neighbors at one morning clinic, it became evident that we had to move to some other town where we were not known, or succumb to force of numbers. We moved to Utuado, said to be the most hungry of all of the Porto Rican municipalities, with a population of 40,000. We rapidly reorganized our work to satisfy the demands we knew would come, and in spite of every care and outside assistance we were again overwhelmed with patients. They came from every barrio of the extensive municipality, afoot, horseback, and in hammocks. As soon as some notorious old anemic, who had spent his last cent to buy iron pills, would return to his barrio from our hospital cured, the whole barrio would swarm about our ears. On July 4, 1904, two members of the commission were ill, and the one remaining handled a clinic of over 700 persons, each one of whom had to have a clinical summary of his case made out, a specimen of his feces examined, and a prescription written, an unvarying rule in all the work done here so far. In addition, a prophylactic talk was administered, and blood counts were made in the afternoon in special cases. Aside from this clinic, we had a field hospital of from 54 to 66 beds, filled with patients registering from 8 to 30 per cent hemoglobin, each one requiring medication of a special nature to meet special complications and intercurrent diseases of so profound an anemia.

Our plan was to leave Utuado for some other town in a month, but we never got away. Certainly this work was none the easier for the two American members of the commission who had to contend with a foreign language, and a dialect at that, and with a people whose customs and modes of life were not well known, even by many educated Porto Ricans; nor was it at all less trying to Dr. Gutierrez, who was taking his part in an unpopular work at the expense of his private interests. In five months our $5,000 was spent, and 5,049 cases had been treated, and we withdrew to San Juan to write the report of the work.

FIRST REPORT.

This report, which, together with those of succeeding years, was published by the insular government, contained 234 pages of written matter in Spanish and English, with illustrations. It comprised (1) a fairly complete history of the disease throughout the world and of the commission's work in the five months' campaign; (2) a discussion of the parasite, its zoologic description, and its life history, together with all possible predisposing causes for the profound anemia observed; the symptomatology, the pathogenesis, morbid anatomy and course, prognosis, and lethality, prophylaxis, diagnosis, and treatment. An appendix to this report gives the details of 61 special cases in which weekly blood records of hemoglobin, counts of red and white blood cells, and differential counts of leucocytes are tabled. Also a synopsis of all deaths, of which there were but 27, or a total mortality of 0.49 per cent.

This report fully demonstrated the cause of death from "Porto Rican anemia," and finally relegated the matter of insufficient and improper food to the secondary place of a mere predisposing factor. It demonstrated beyond a reasonable doubt that uncinariasis was contracted through contact of the healthy skin with infested earth, the first practical demonstration on a large scale of Loos's beautifully clear laboratory experiments; and, above all, it convinced the people of Porto Rico that they were dying of a curable disease; that their entire laboring class was threatened with at least semi-invalidism; and that it could be successfully combated with a drug which had been hitherto unjustly accused in Europe of being a dangerous and unjustifiable remedy. The manner in which the Porto Rican people received this report does them fine credit, not at all understood or appreciated by outsiders, and sweeps away all the bitterness of five years of apparent indifference for which they were really largely excusable. From that time to the present this work has been loyally supported by larger and larger appropriations each year, made by the Legislature of Porto Rico.

Not that we failed to encounter ridicule, indifference, skepticism, and in some active opposition, for we did, and plenty of it, but we have never yet seen the man who made it his business to see the work

at close range, talk to our patients, and see results who was unable to acknowledge the truth—even more than this, we rarely noted that such a man failed to catch the enthusiasm for the work which so commends itself to not only the head, but the heart.

While we worked in the mountains, while the unschooled but keen observer, our patient, spread far and wide among his relatives and friends a truth that had brought him health and long-sought vigor, there were some men in the large cities of the island who either could not or would not take the trouble to verify our work, but who, nevertheless, did not neglect an opportunity to ridicule and criticize it. And that criticism went beyond Porto Rico.

The following is a quotation from Los Pueblos Hispano-Americanos en el Siglo XX, 1904–1906, by Ricardo Beltran y Rozpide (of the Royal Academy of History, secretary general of the Royal Geographical Society, etc.), printed in Madrid, Spain, 1907. This writer, after accusing the "Yankee usurers" of exploiting the island for pure lucre, says:

[Translation.]

Having obtained the greatest possible profit, and the consequences of the damage they had done obliging them to take a new tack, they considered that there would be no danger in boasting of humanitarian sentiments, and so went to the assistance of the extenuated Porto Ricans, carrying their remedy in the form of a flamant commission charged with studying one of the most difficult problems of medical science—the cause of death from hunger.

Not only the common people but even the most erudite doctors who have not had the luck to have been born in the land of the Yankees have always believed that death from hunger is a consequence of a lack of food, and that when food is scarce and severe anemia comes, this can produce death.

The studies of the commission cited have demonstrated the error of those who thus reasoned. The anemia of Porto Rico is * * * an epidemic. There one does not die of hunger or of anemia due to insufficiency or lack of food. * * * Conclusion—there is no necessity for worrying about giving food to the hungry and anemic Porto Ricans. Only a vermifuge to expel the little worms from the body of the sick man. * * * According to the cited report, a similar epidemic exists in the Philippines. Therefore its appearance coincides in Porto Rico and the Philippine Archipelago with the establishment of the sovereignty of the United States, and it would be unjust to deny them the right and honor of giving their name to the epidemic—it ought to be called the "Yankee pest."

Such a tirade is cited merely as an example of senseless attack upon the work. Any well-informed Spanish physician could have enlightened this particular writer, who from his titles should be a very learned man.

By contrast we quote, also from a Spanish pen, the interesting proceedings of the Royal Academy of Medicine of Madrid, session of the 1st of April, 1905, Revista de Medicina y Cirugia, May 21, 1905 (año XXIX, pp. 275 and 276):

After Dr. Larra, who, in a discussion on ankylostomiasis, recently discovered in the mines of certain parts of Spain, had given a succinct account of the workings of the Porto Rican Anemia Commission, Dr. Alonzo Sañudo stated "that in the early days after Porto Rico had fallen to the Americans, he received a pamphlet of a military surgeon through which he had come to know that that gentleman had presented before the Academy of Medicine of Porto Rico, the 26th of December, 1903, a communication which declared that the anemia then observed was due to a parasite, causing him (Dr. Sañudo) profound bitterness when he saw that an American physi-

cian had studied this matter, while the Spaniards during our domination had done nothing in this direction."

We also cite another author, whose name will command respect and especially ours, who realize that it takes considerable courage to speak frankly "of those things which we have left undone," Dr. Jose Codina Castellví, of the General Hospital of Madrid: In "La Anquilostomiasis Considerada como un Nuevo Caso de Accidente del Trabajo," an address delivered in 1906 before the Royal Academy of Jurisprudence and Legislation of Madrid (printed in Barcelona, establishment of Serra Hermanos y Russell, Ronda Universidad, 6), we find the following:

And is it not shameful, gentlemen (for it is necessary that good works, in order that they may be known and may serve as a stimulus, be divulged on every propitious occasion), is it not shameful that after having been ours so many years Porto Rico, just as we lose her and thanks to an investigation made in said island by order of the United States, we come now to know, and only now, that 90 per cent of that anemia from which the rural population of Porto Rico is suffering and which we limited ourselves to calling tropical is nothing more than the anemia of ankylostomiasis!

The only comment we have to make is that Porto Rico was the means of attracting the attention of the United States to an infirmity of her poor whites in the South which for at least a century had passed for malaria, and even rank laziness, and that the Southern States can even now follow the example of this little island which, though poor, is paying out her money to redeem her laboring classes.

Taking up the thread of the narrative, whose quotation was interrupted to reveal the comments upon this first report here and abroad:

In the year 1905–6 we decided to have our central dispensary and field hospital and administer from this unit as many substations as our meager funds would permit. Recognizing that the highlands of Porto Rico were the most needy, Aibonito, a town in the mountains, was chosen, and around it were grouped in little towns the bulk of the substations. Apart from these surrounding towns were placed one large station at Lares, a mountain town of the west, and one in Utuado, in the center of the island.

In 4 of our 10 stations the town offered to bear all expenses if we would administer the work and furnish the medicines. The physicians volunteered their services. This alone will demonstrate the excellent spirit prevailing.

SECOND REPORT.

Our second report contained 176 pages and reports 18,865 cases. It demonstrates that—

(1) The keynote of the campaign looking toward an effective reduction of the frequency of the disease must depend on the treatment of all persons infected, on personal direct education of the laboring classes by lectures and pamphlets, and on a complete reformation of the public health service in Porto Rico.

(2) Ground itch is the first sign of infection, and to avoid it shoes should be worn and earth pollution stopped.

(3) The coffee districts of Porto Rico are the most intensely infested of all regions in the island.

(4) Five doses of thymol given a week apart are sufficient to practically cure nearly every patient and to reduce the power of infectivity of the patient to the soil about nineteen-twentieths.

In addition, a full plan for future work is laid out, and it is brought forcibly home to all that from this time on the extermination of Porto Rican anemia is largely a matter of money. Not the least of the labors of this year was the counting of all uncinariæ expelled after each dose of thymol in 40 cases and after each dose of betanaphthol in 30 more. This was most tiresome and disgusting, but a fruitful work, as we established the fact that after even one dose 74.54 per cent of the parasites were expelled.

On receipt of this report, again the Legislature of Porto Rico trebled their appropriation of the year before, and the third year's work began.

At this point Drs. Ashford and King returned to their services and Dr. Pedro Gutierrez Igaravidez took the directorship of the work.

PERMANENT COMMISSION ESTABLISHED.

In view of the fact that the Porto Rico Anemia Commission of the previous two years had demonstrated beyond a doubt the extent and curability of uncinariasis, the legislature of 1906 passed a law organizing for the first time a permanent commission for the extermination of uncinariasis in Porto Rico.

Gov. Winthrop appointed Dr. Gutierrez Igaravidez as president and Drs. I. Gonzales Martinez, of Mayaguez, and Dr. F. Sein Sein, of Lares, as members of that commission on June 25.

This commission, after discussion of the problems before them, in accord with the plans of the previous commission, considered it necessary to continue the work by means of dispensaries as in preceding years, thus offering to every man, woman, or child suffering with uncinariasis a microscopic diagnosis, a free specific for his disease, and printed matter and verbal explanation of the endemic, which would tend to disseminate the facts among his neighbors and friends and thus popularize the reform undertaken.

The requests for dispensaries from nearly every town in the island showed the desire of the people that the campaign be made to cover, so far as resources permitted, every particle of ground possible; the commission realized the justice of these requests and decided to establish the largest number of stations feasible.

DISPENSARIES OPENED.

As the practical problem outweighed every other consideration in the fight against this disease, both from the standpoint of prevention and cure, the commission directed its efforts rather toward this phase of the question than to the scientific work which more time and money might have made also possible. Each month, as soon as they could be organized, dispensaries were opened in some towns, until 35 were found working at the end of the fiscal year 1906 and 1907. In order to better administer the stations and supply them, the island was divided into three districts, one for each commissioner. The central station was established near San Juan and directed the entire work.

Each commissioner and some of the directors of dispensaries were permitted to place in the municipal hospitals, at the expense of the service, certain seriously ill anemics, who were unable to return to their homes, and who, apart from this, offered opportunities for clinical research and for the study of the effects of new remedies for the expulsion of the worm.

In the 35 dispensaries in operation in the year 1906–7 89,233 persons were treated, of whom 43.09 per cent were cured. The remainder, for reasons before expressed, could be considered as having been relieved of such an overwhelming number of their parasites as to no longer suffer clinically from the disease. In addition, such patients possessed only a small fraction of their power for infestation of the soil. The mortality was but 0.21 per cent. The records kept of these patients was the same as kept in previous years; a card of identification corresponding to the serial number of the history card kept at the dispensary was given each patient.

LITERATURE DISTRIBUTED.

Printed circulars were widely distributed, in which the nature of the "anemia" of Porto Rico was made plain, and also the manner of contracting it and the means of avoiding it. These circulars reached the planters and interested them in sending patients to be cured at the dispensaries. In addition to this, each patient on receiving his medicines was issued a colored card with printed instructions as to the manner in which they should be taken and the means that should be adopted to avoid infection. In conjunction with the above prophylactic measures, the commission wished to try out the effects of sanitary inspectors who would visit the country barrios (or townships), and who would speak in the homes of these people of the campaign that was going on, investigating at the same time the general health conditions prevailing in each home and advising those who had not visited the dispensary to immediately take up the treatment of their curable affection. These inspectors left

a card of explanation at the houses and noted under the printed headings of another card the information required of him by the commission. But lack of funds only allowed three such inspectors. These methods brought a greater number of sick to the dispensaries, caused latrines to be constructed where before there had been none, and would have been even more fruitful of good had enough money been available to employ more inspectors.

SCIENTIFIC STUDIES.

Although the cure of the greatest number of sick and the instruction in prophylaxis were the principal objects of the work of this and following years, we note in addition some scientific studies worthy of special mention:

(1) The discovery of the presence of *Ankylostoma duodenale* by Dr. Gutierrez, in the central station at Rio Piedras in the person of a native Porto Rican who had never been out of the island, thus proving the coexistence of the Old World and New World species in Porto Rico.

(2) The trial of Phillips's eucalyptol and chloroform treatment for the expulsion of the worm by Gutierrez. This treatment was not as successful in the hands of the commission as it was reported to have been by its author. The patients thus treated suffered greatly from dizziness, lethargy, somnolence, and fainting spells. Some grave cases of collapse occurred, and, as many of them refused to continue the treatment by this medication, it was abandoned.

(3) The study of tissues recovered from autopsies performed by the first anemia commission in cases of fatal uncinariasis. These tissues were sectioned and stained by Dr. Ashford, in Washington, and studied there by him, Dr. King, and by the late Maj. James Carroll and Maj. F. F. Russell, both of the Army Medical Corps.

(4) The study of the influence on the urine of uncinariasis and the anthelmintics used for the expulsion of the parasites. These voluminous notes were compiled and reported by the first commission and are found in the reports for 1906 and 1907. Notes on animal experimentation performed by Gutierrez and Ashford at the close of the last year were compiled, and sections from the human intestines of the worm in situ were photographed by Dr. William Gray, of the Army Medical Museum.

REPORTS FOR 1907 AND 1908.

The report of 1906–7 contained 206 pages and was illustrated.

The next year, 1907–8, the legislature again appropriated a sum for the continuance of the work, and the 35 dispensaries founded in the preceding year were continued, although some were moved to other towns, and 7 more dispensaries were added, making 42 in all. The service in this year followed the plan of the last year, and 81,375 persons were treated, with 51.54 per cent cured and a mortality of 0.12 per cent.

In 1908 the legislature did not appropriate any funds for the continuance of the work, so that it was necessary to close all stations June 30, 1908. Nevertheless, surplus medicines on hand permitted many former directors of dispensaries to continue treating applicants, which they did without remuneration from the insular government.

A special session of the legislature was convoked by proclamation of the Governor to consider the irrigation project for the island and the anemia problem, and in September, 1908, the legislature made a modification of the law placing the work of the commission under the department of health, charities and corrections, as a bureau of that department, with the name of anemia dispensary service. The director of this service was Dr. Gutierrez, who began in October to organize it.

In November, 1908, after a month's work in organization, the old dispensaries were gradually restored and the total number increased to 59. The number treated this year plus those treated in the five preceding months by voluntary service by the former directors of dispensaries reached 54,725, of whom 41.49 per cent were cured and 0.08 per cent died. In addition, 9,159 were treated as patients of former years, making a total of 63,884 treated in 1908–9.

* * * * * * *

The following table gives a succinct statement of the work to date:

Summary of anemia work.

Years.	Patients treated.	Age.			
		Under 10 years.	Between 10 and 30.	Over 30.	Not recorded.
1904-5	5,490	566	3,138	1,764	22
1905-6	18,865	2,199	11,532	4,922	212
1906-7	89,233	8,913	51,972	28,232	116
1907-8	81,375	8,954	52,608	19,152	661
1908-9	54,725	6,668	34,905	13,152	.....
1909-10	37,880	4,877	24,294	8,709	.....
Total	287,568	32,177	178,449	75,931	1,011
Percentage	.....	11.18	62.05	26.40	0.14

CLINICAL TYPE.

Years.	Very light.	Light.	Medium.	Intense.	Very intense.	Unclassified.	Number of visits.	Number of deaths.	Amount spent.
1904-5	.....	1,222	1,063	2,258	.....	947	22,000	27	$4,954.84
1905-6	1,378	4,483	8,706	3,501	440	357	76,896	67	10,808.77
1906-7	7,085	19,503	38,439	19,212	4,162	832	425,131	193	49,116.31
1907-8	3,022	14,968	40,136	19,140	3,465	644	472,407	93	56,950.57
1908-9	.....	10,720	24,248	16,409	3,334	4	305,598	46	32,360.91
1909-10	.....	7,751	16,539	11,537	2,053	.....	.....	47	29,706.98
Total	11,485	58,647	129,131	72,057	13,464	2,784	1,302,032	473	183,898.38
Percentage	3.99	20.39	44.90	25.05	4.68	0.96	.....	.....	.....

Cost of treatment per patient, 63.9 cents.

One of the most interesting features of the campaign against uncinariasis has without doubt been the contribution made to the study of the disease by the medical men of the island from the point of view of microscopic diagnosis.

No sooner had the commission been formed and its members had proceeded to systematically examine the feces of all who solicited treatment than there awoke in our colleagues who visited the clinics of the first commission in Bayamon, Utuado, and Aibonito, and at those of the second in Rio Piedras, Mayagüez, and Lares, the desire to scientifically fix their diagnosis of "anemia due to uncinaria" by microscopic examination in all of their own cases. The natural consequence of this was the acquisition of microscopes, of which there were very few when the commission began its labors, for up to this time, with the exception of the Government laboratories and the offices of a very restricted number of men in private practice, the microscope had not taken a very prominent place in practical work. The majority of physicians were not familiar with microscopic technique, some because they had not made any special study of it, others because in their daily practice they had forgotten how to use this instrument. Considering all of these things, the labor of the Porto Rican physician who so promptly realized his position in the scientific world and without doubts or vacillation hastened to take his part in the struggle against the disease by first learning to recognize its etiological factor, the ovum of the parasite in the feces, demonstrates

how sincerely interested he was and how eager to press forward in the advance of medical science.

From that moment began the demand for microscopes; many physicians bought them, others received them from the municipalities, and others were loaned them by the commission. Practically there is not a town to-day in Porto Rico that has no microscope, from one source or another.

Along with this scientific movement came the dispensaries, which caused a revolution in the health service of the municipality, because the physician from that time on fixed a definite place and hour when he might see the anemics, which practically embraced the entire working population of the municipality.

The benefit extended to the sick poor by this organization of the medical service whereby they could be rapidly examined and properly attended was keenly appreciated by those whose difficulties heretofore had been well-nigh insuperable.

While the commission was putting into practice in Aibonito its plans, first developed in Bayamon and Utuado, of extending the campaign to a number of towns, Dr. Isaac Gonzalez Martinez conceived the idea of forming a league against uncinariasis, but the time was not yet ripe for the realization of his ideals, and unfortunately it had only a short life. This was, however, no obstacle to the systematic campaign carried on by the legislature on the one hand and the practical one begun by the individual efforts of the medical men of the island on the other. To-day, warmly seconded by the approval and personal interest of everyone in Porto Rico, a service has been provided which, although its resources are modest for the enormous responsibility it carries, proposes to carry into the mountain barrios an efficient organization, confiding in the towns to sustain the burden of the dispensary work within their immediate limits and hold tight to the territory so far won. The service in charge of this work is denominated the "service of tropical and transmissible diseases," the successor of the "anemia dispensary service" of 1908, which was in turn the successor of the Porto Rico anemia commission. All of these services carried the same idea: The reduction of mortality and morbidity among the laboring classes of Porto Rico, at first attacking anemia merely; later, after realizing the hold it had begun to get on that formidable enemy of the poor workingman, not only anemia, but all tropical and transmissible diseases.

The sum total of persons treated for uncinariasis to June 30, 1910, is 287,568. This represents the work of the commission and its successors, the anemia dispensary service, and the service of tropical and transmissible diseases, since the beginning of the campaign of 1904. We estimate that at least 30,000 more have been treated apart from Government work and of which we have no record. We are entirely safe in saying that over 300,000, or nearly one-third of the population of Porto Rico, have received specific treatment for uncinariasis.

A CLINICAL STUDY OF UNCINARIASIS.

The clinical investigation of uncinariasis has always seemed to us to have been less carefully studied than its parasitology and associated problems of prophylaxis. The aim of this chapter is to place before our readers as simply and as concisely as possible (1) the composite picture of the disease uncinariasis; (2) a detailed discussion of the clinical features; (3) the results of clinical laboratory investigation.

Many otherwise excellent treatises on this disease dispose of the clinical features by giving what is little better than a mere list of symptoms from which the patient may suffer, without sufficient reference to the deeper underlying bases upon which these manifestations are founded. This bundling together of symptoms without the constant check of the clinical laboratory has led some writers to believe that the symptoms of uncinariasis are solely those of a more or less intense anemia. It is our opinion that this is far too restricted a view of a disease which is a clinical entity, in spite of its protean forms, and even in spite of the prominence of one of its best-known symptoms.

We assume and believe that uncinariasis is a toxemia. We assume it from the cumulative evidence that our direct personal observation of about 13,000 cases affords us, and we believe it from the confirmation of our assumption in the experience of those who, under our direction, have treated in a more or less similar manner about 275,000 more.

It is proven that the introduction of the malarial parasite into the circulating blood causes the phenomena of "malaria" the moment that endogenous sporulation has produced a number sufficient to overcome the natural resistance of the body to their influence. Do these phenomena take place because the parasites devour red blood cells or because they liberate poisons? Most of us feel that we can venture upon a fairly secure answer to this question, even in the absence of proof that a "toxin" exists.

It is equally well proven that uncinariasis is caused by the closely related *Ankylostoma duodenale* and *Necator americanus*, which for the practical purposes of a physician can be considered as identical. We desire to present enough evidence to permit the entirely reasonable belief in a poisonous product of these parasites, causative in large measure of the clinical picture which we are called upon as physicians to consider.

We make this statement to expressly disavow any claim on our part to the discovery of this "toxin," which is as yet wrapped, as is the product of malarial infection and the virus of typhus, in an impenetrable mystery.

Clinical Type of the Disease.

Varieties of acute and chronic uncinariasis may be recognized, and to these may be added another in which an acute supervenes upon a chronic form.

For convenience, three grades of the disease are distinguished, (1) slight, (2) moderate, (3) marked.

But the temptation to reduce uncinariasis to a number of distinct varieties can be fairly said to have failed. The disease is too insidious and too complex in its manifestations to harness to any unyielding classification of forms. There are forms of the disease really quite distinct the one from the other, but they are the exception.

Calmette and Breton mention a large number of clinical forms, such as the acute dyspeptic, the chronic dyspeptic, the anemic, the icteric, etc., but as a matter of fact there are an abundance of cases which present the essential features of all these "forms." Lutz has a cumbersome classification, too long to repeat here. It is carefully worked out, but impracticable, because it is too complex and fails, as do others, for the above-mentioned reason.

We believe that the only classification of the manifestations of the disease which is simple is that which divides it into light, moderate, and marked types, a division based upon its intensity. Our decision to so classify was made for a very practical reason: We had a large number of stations throughout the island. To have confided the estimate of the form of uncinariasis to each one of our many assistants would have been to have had great confusion in our summing up of the total results of the work. The simpler division was far less exposed to error and we had the security of knowing that every one knew just what was meant by the three types we suggest here. In the rush of a busy clinic it is necessary to reduce to a very few words a fairly faithful picture of the sick man, and this classification gave us the type, while upon the same card was a space for "most prominent symptoms." Our subdirectors of stations here entered, first, the system or systems especially involved and all curious or unusual or interesting features of the particular case thereafter.

Stiles (Osler's System of Medicine, vol. 1, 1907) desires to establish under symptomatology a classification not based upon the symptomatology of the disease, but upon the degree of infection "suggested as a compromise between the classification proposed by the writer in 1902 and that used by Ashford, King, and Gutierrez (1904)." We can not accept this classification by the eminent zoologist, as it is contrary to the meaning of "disease" and "symptomatology." It is manifestly impossible to speak of the symptoms of his "light infections," for under his classification there are none. And it is certainly not proper to consider such a person as suffering from uncinariasis, in a medical sense, when he is no worse off than the symptomless "carrier" of typhoid bacilli. Let us speak, under the head of symptomatology, of the manifestations of the disease uncinariasis. Later we will treat, in its proper place, of worm carriers and worm sick. As soon as the stress and strain of the worm carrier's life, perhaps with the incidence of privation or of other diseases, breaks through his relative immunity, he is apt to demonstrate some of the symptoms of uncinariasis and become worm sick, although no more worms, or even less, may be harbored. With the

exception of a few, whose relative immunity is pronounced, these individuals contain comparatively few worms. But when they become hosts of from 300 to 400, symptoms of the disease make themselves manifest unless resistance to the poison is still sufficient to ward them off.

While, therefore, uncinariasis is largely a question of intensity of infection, it does not follow that one can base a classification upon the relative number of worms a host may harbor.

In the course of this chapter reference is made to several authors whose observations have been especially interesting to us in preparing this work. The literature upon this subject is now very abundant, and, rather than burden this work with a bulky bibliography, we take the liberty of recommending the following treatises, to whose authors we make frequent reference. The difficulty has been that the vast majority of the most eminent students of the parasite have not had the variety of cases, especially the severer grades of the disease, from which to make a complete study of the clinical manifestations caused by a number of parasites sufficient to make a man really very ill.

1. "Über Ankylostomiasis und Ankylostomum duodenale," by A. Lutz. Volkmann's Samml. klin. Vortr., Nos. 255, 256, and 265. 1885.

This admirable clinical study has been frequently quoted in works treating seriously of the symptomatology. Although written 25 years ago, the observations were made upon patients seriously ill of the disease in a heavily infested region of South America which has already been made famous by writers on uncinariasis. The work can still be considered a classic.

2. "Observations on 400 cases of anchylostomiasis," by F. M. Sandwith. Written for the Eleventh International Medical Congress, held in Rome. 27 pp. 8°. London, 1894.

This is a treatise similar to the previous one, valuable for the concise and clear exposition of the symptomatology of the disease as observed in heavily infested Egypt.

Neither of these two works make special use of laboratory methods for clinical research.

3. "An Outbreak of Ankylostomiasis in England." By A. E. Boycott and J. S. Haldane. Jour. Hygiene, Cambridge, vol. 111, No. 1, Jan. 1, 1903.
"Anemia in Ankylostomiasis," by A. E. Boycott. Brit. Med. Jour., London, Nov. 9, 1907.

The study made of the blood in these two treatises is well worth perusal. The observers investigated the disease as it presented itself in the mines of Cornwall. The general type, with the exception of a few cases, seems to have been moderate and light.

4. "Ueber das Wesen und die Verbreitung de Wurmkrankheit." By Loebker and Hayo Bruns. Imperial Health Office, Berlin, 1906.

This work is an excellent one, not only for the symptomatology, of which it treats at length, but for the scientific manner in which the entire subject is discussed and for its thoroughness and at the same time its clearness of exposition. The clinical material was drawn from light cases in the mines of Westphalia and from a general review of the literature. The character of the scientific research at the Gelsenkirchen laboratory by Bruns and his associates is too well known to need further encomium on our part.

5. "Per lo studio dell' anchilostomiasi." "Nuove ricerche ed osservazioni sull' anchilostomiasi." "Eosinofili del sangue ed elminti intestinale nell' uomo," by P. D. Siccardi. "Osservazioni cliniche e sperimentali sull' anchilostomiasi," by M. Spargella. "Note sulla diffusione dei vermi intestinali e sulla loro importanza clinica," by L. Messedaglia.

All of these theses are published together in "Lavori Dell' Istituto," volume 111, Studi di elmintologia clinica, 1905–1907, Milano, 1907, Istituto di clinica medica generale della R. Universitá di Padova. This bulletin of the University of Padua, containing 435 pages, is really a notable one. For remarkably clear and unequivocal language this work, to our mind, surpasses all. It is true that we may be influenced in our opinion of this book by the confirmation of practically all of our own clinical impressions set forth in 1902 and 1904, but, in addition, experimental work of an entirely original character is reported, which has contributed much to the better understanding of some quite obscure points in the disease.

The work of Siccardi is especially valuable, as he fearlessly cuts into old and worn-out theories and false deductions with the knife of a surgeon, brilliantly refuting doctrines no longer tenable in the modern conception of uncinariasis and basing his views largely upon his own personal and laborious work. These theses are essentially those of clinical research in which the laboratory contributes its important part.

The histories of the cases recounted in the appendix to our own work are made as brief and concise as possible, and many details are purposely omitted which might be of interest, but whose omission does not alter the conclusions drawn. These cases, plus our direct personal observation of about 13,000 others in clinic and hospital, and our indirect observation of about 275,000 more, serve as the basis for our conclusions with respect to uncinariasis. The "study cases" (see appendix) are those of uncinarial anemics placed under our continuous observation in a field hospital near our headquarters from the day they first consulted us until they were discharged cured, died, or deserted. We believe their histories to be fairly complete, as they were taken with extreme care and all data were collected by us personally. The supplementary data accruing from the enormous daily clinic of out-patients are also taken from a written history made in each case, but parts of these histories are not at all complete, owing to the physical impossibility of handling with a sufficient force the numbers they represent.

After these preliminary remarks, we may now describe succinctly what we mean by light, moderate, and marked cases. In previous years we have spoken of "very light" and "very marked" cases. We can not see that such multiplicity of terms adds anything to the better understanding of the classification adopted here, so we have combined "very light" and "light," and "marked" and "very marked" cases, and described them, respectively, as "light" and "marked."

LIGHT CASES.

Such are those who possess little or no pallor, or, at best, show but an indefinable dirty yellow tinge of the skin in whites, a slight pastiness in mulattoes. In general such patients are "sallow." There is a reduction in the amount of perspiration.

This is the grade of uncinariasis in which we find the patient quite communicative with regard to disturbances of the digestive tract, for the other systems are not yet sufficiently involved, as a rule, to seriously attract his attention. The disturbances are manifested by pain in the epigastrium, especially after eating, with heartburn, flatulence, and weight and fullness in the epigastrium. There is some tenderness in the same region and an unusually large appetite. Exceptionally the appetite is poor, the pains are intense, and nausea and vomiting are frequent. In the vast majority of cases the feces do not reveal anything out of the ordinary, save ova of uncinariæ.

In the circulatory system physical examination reveals but little. There is apt to be some degree of overaction of the heart and increased frequency of the pulse. There may be slight breathlessness after exertion and some palpitation. A little dizziness may make itself manifest. The most prominent symptoms, next to those of the digestive, are to be found in the nervous system. There is a distinct reduction in mental activity. Distaste for work, apparent laziness, indifference, abstraction, and a tendency to forget are manifest. The facial expression bears out the conditions mentioned. There may be a tendency to sleep in odd moments. Headache may be complained of from time to time.

The hemoglobin of such persons generally lies between 60 per cent and normal, the former sometimes in spite of good color. The erythrocytes are apt to be normal in number. A frequent sign is eosinophilia, and a very early one. To sum up the clinical picture of a light case, therefore, we may say that an individual, previously vigorous and energetic, gradually finds himself losing in strength and inclination to work, with symptoms of "dyspepsia" and perhaps with a faint pallor. To his friends and neighbors he is "run down." To unfriendly eyes he is lazy and "good for nothing."

MODERATE CASES.

These form the usual type seen in Porto Rico, although, naturally, at the beginning of the campaign, in 1904, marked cases predominated among those applying for treatment. Here all symptoms noted under light cases are more pronounced. The pallor is definite and is demonstrable in the mucous membranes. The skin is quite dry and sweating is rare. Patients frequently complain of pruritus.

In the digestive system we note that the appetite may become voracious, even to bulimia and geophagy. Nausea and vomiting are less rare. Meteorism begins to become troublesome, and with it, at odd times, enteralgia and abdominal tenderness. The bowels, while usually normal or constipated, become at irregular intervals loose, with the evacuation of undigested food in vile-smelling stools. There is, in other words, intestinal indigestion, with the attendant phenomena, a natural sequence of overstuffing plus inactivity of the digestive organs.

Some cardiac hypertrophy can often be made out with its attendant signs. The pulse is more rapid and at times even weak and compressible. Palpitation of the heart is here a prominent symptom, is liable to be severe, and is not always relative to exertion, which latter, however, usually brings on breathlessness. Precordial pain, sharp or dull and prolonged, follows great efforts. A hemic murmur is, as a

THE MORNING CLINIC, DISPENSARY AT AIBONITO, 1905.

All grades of disease in this group save very severe form.

A TYPICAL "SEVERE CASE," ARECIBO, 1909. CONTRIBUTED BY DR. ROSES ARTAU, DIRECTOR OF THE STATION OF ARECIBO AND DISTRICT CHIEF.

This man was 25 years of age, had many ova of uncinariæ in his stools, and was utterly prostrated. Blood record at time of this photograph was as follows: Hb, 12 per cent; red cells, 876,000 per c. m.; white cells, 9,000 per c. m.; percentage eosinophiles, 4.3. His temperature was 36 degrees C., and the urine revealed one-half per cent albumin and a strong indican reaction. Result of treatment: cured.

rule, readily defined, and pulsation of the vessels of the neck is noticeable. There are much dizziness, especially on sudden changes of position, noises in the ears and frequent headaches. In general, the circulatory system has taken precedence over the digestive system in the patient's estimate of his own condition.

On the other hand, the mental picture is the prominent one to the man's friends. If the symptoms referable to the nervous system are prominent in light cases, they occupy a truly important place in the moderate grades of the disease. The subject is decidedly depressed, quite passive to his surroundings, and appears densely stupid or confused, or both. The mental condition is still more strongly reflected in the facial expression and is heightened by the pasty complexion in the now frankly "anemic" patient. Sometimes the patellar reflex is exaggerated, but more often it is diminished. There is susceptibility to cold and tingling of the feet, which frequently "go to sleep." Partial impotence in men and amenorrhea in women are noted. Blurred vision and other signs of visual troubles make their appearance.

The urine may reveal albumin by delicate tests.

No emaciation is noticed, but the muscles are flabby, a little painful, and quickly tire. Work is undertaken with a distinct effort. There is much pain in the sternum and chest and a feeling of weakness in the knees and legs.

The hemoglobin is apt to lie between 30 and 60 per cent, the red cells hover around 3,500,000 to 4,000,000 per cubic centimeter and the eosinophilia is at its height in this class of cases.

In a few words, the patient looks and feels definitely sick. There is no longer mere disinclination to work, but partial inability. He is pale, exertion brings on throbbing of arteries and palpitation of the heart; sudden changes of position, sudden dizziness. He is half narcotized, as it were.

The subject can be described as a moderately anemic individual with minus activity of mind and body.

MARKED CASES.

Here the patient has arrived at that stage where a fatal termination may occur at any time. The yellow pallor is extreme, and it is at times difficult to say where the mucous membrane of the lips begins and the skin ends. Edema of the feet and ankles alone, or this and puffiness of the face, or, not rarely, extreme anasarca, are seen. The patient seldom perspires, the skin being dry, harsh, and wrinkled.

The digestive disturbances have changed in character, appetite is often nil, often enormous. Some of the worst forms of geophagy are noted in this grade. Nausea and vomiting are frequent, not rarely aggravated by dilatation of the stomach. Diarrhea may alternate with constipation. The former predominates and is apt to become serious; even enterocolitis may supervene, but, as a rule, without blood. The best description of these diarrheal movements is that they are composed of putrefying, indigested food mixed with mucus. Meteorism and concomitant symptoms mentioned under moderate cases become exaggerated.

It is in this grade of the disease that the hypertrophied heart tends to dilate, with a weak, running, compressible pulse, often becoming

irregular, and tremendous pulsation of the great vessels at the base of the neck. It is not at all infrequent to note venous pulsation with bruit-de-diable of the jugulars and the phenomena of passive congestion of all viscera. The murmurs are loud and well defined or obscure, muffled and confusing. Diffuse pulsation of the precordium is noted and severe palpitation and precordial pain are the subject of bitter complaint by the sufferer. There is distressing dyspnea on the slightest movement and sometimes when the patient is perfectly quiet. Dizziness and a roaring noise in the head are marked. Effusions into pericardium, pleuræ, peritoneum, and cerebral ventricles may be expected. Edema and passive congestion of the lungs are apt to occur. Syncope is not unusual, and the patient is often afraid to stir out of his house, if, indeed, he can muster the strength to do so.

The nervous system suffers very severely. In addition to all of the mental confusional states before noted, manic depressive insanity may supervene. There is much headache and insomnia, the patellar reflexes are abolished and paresthesias become very marked. In men, impotence is an almost invariable symptom; amenorrhea in women. The vision is blurred and the pupil tends to dilate. These patients can not get enough covering; they will shiver in the shade in this tropical country if a breath of air strikes them.

The urine has a low specific gravity, is abundant in quantity, and often contains albumin, but usually only a trace, and casts.

The muscles are flabby, sore, and painful. Extreme weakness, even to the simulation of paralysis, is observed, and the patient is incapacitated for labor. There may be irregular fever, with intervals of subnormal temperature. Marked cases generally have a hemoglobin percentage below 30. As a matter of fact, with regard to blood changes in this grade of the disease, it is better to consider cases that are "marked" and those that can be said to be "very marked." In the first we can expect a hemoglobin between 21 and 30 per cent, with often a well-marked eosinophilia, and a red cell count ranging between 2,000,000 and 2,500,000. In these cases the anemia is still a manifestly secondary anemia, with predominance of microcytes and a low color index. In the second or "very marked" cases the hemoglobin falls below 20 per cent, and the lower we get the more apt we are to find that the eosinophilia has disappeared, that the clear picture of a secondary anemia fails us, that macrocytosis, not microcytosis, is dominant, and that myelocytes and megaloblasts are increasingly frequent. The color index in these cases at times exceeds 1., and the picture may then be well considered as one of pernicious anemia. In these very marked cases the red cells tend to fall to very low figures.

In general review of all that has preceded, we are enabled to see why Sandwith divides the clinical phenomena of uncinariasis into (1) digestive, (2) circulatory, and (3) nervous cycles.

Uncinariasis is a disease, therefore, caused by infection with a sufficient number of these parasites to overcome the natural or racial immunity of man. Its manifestations depend on (1) the number of worms harbored, (2) the length of time they have lived in their host, (3) the susceptibility of the host to their hypothetic poison.

The effects of such infection are modified by (1) concomitant disease or weakly constitutions; (2) the involvement of organs, such

as heart, kidneys, brain, blood, etc., to an extent which markedly disturbs their functions and thus establishes a vicious circle for their own further destruction; (3) the ability of the patient, from his position in life, to resist this poison. Good food, a life sheltered from privation and excessive manual labor, and absence of concomitant disease make for strong resistance. When, however, we consider the obligation of the poor to engage in hard manual labor, to work without shoes, exposed to daily infections in the rain and through long hours, remunerated by half shelter in a poor hovel and the coarsest and most indigestible food, poor in proteids, it is easily seen why the worst victims are to be found among the country laborers.

It has been an unvarying rule of the directors of this work in the island to make a personal history for each patient applying for treatment at our dispensaries, and cards for this purpose are on file here with the data called for in the printed headings. Their mere bulk, if nothing else, would require many months for compilation of all the clinical data they contain, but it will perhaps suffice to state that all give:

1. Current case number.
2. Name.
3. Barrio or township in the municipality.
4. Date.
5. Color, age, sex, and social position.
6. Occupation.
7. Statement as to presence or absence of a special place for defecation, such as latrine, earth closet, etc.
8. The clinical type of the disease in each case, synthetized from the general appearance, the physical examination, and the personal history.
9. Whether or not the patient had mazamorra or uncinarial dermatitis, and, in case of an affirmative, where same was acquired.
10. All varieties of parasitic ova in the stools and relative number thereof.
11. Most prominent symptoms.
12. Complications and intercurrent diseases.
13. Treatment.

In the eleventh item it was found convenient to make such notes as "circulatory system, marked," "nervous system, slight," "intense pallor," etc., thus accentuating the particular system or systems most notably involved in the classical picture usually presented. Thus, in a few words and without the minutely detailed history, we were able to preserve a fairly clear idea of the state of our patient on admission to clinic. The necessity for these abbreviations will be seen in the large daily clinics we handled (from 200 to 700) and our scanty funds, prohibiting the employment of adequate professional assistance.

In the thirteenth item the dose of the specific, the dose of the purge, and the relative number of ova of uncinariæ remaining were noted, in addition to any remarks of interest during the course of treatment.

The large clinics each day will be better understood when one thinks of our instructions to each patient, i. e., that they should return every week until their feces revealed a complete absence of ova of uncinariæ.

The following series of cases form the basis in our discussion of the clinical features of uncinariasis for the percentage frequency of the phenomena which make up the picture of the disease in Porto Rico.

These cases, in contradistinction to the "clinic" or out-patients, were hospitalized under our immediate daily observation. Their histories were taken with great care and are fairly complete. We say "fairly" because in some series predominance is given to one line of clinical investigation over others. Again, in some series certain well-known and practically universal symptoms were not noted, and without the expressly written record we have not presumed to depend on generalities to cover such gaps, preferring to exclude from a percentage estimate, series in which that particular symptom was not uniformly reported upon.

With these preliminary remarks we may consider the various series in their order:

(*1*) *Ponce series of 1899.*—This series comprised 19 cases.

Age:	
Under 10 years	None.
Between 10 and 14 years	1
Between 15 and 24 years	5
Between 25 and 40 years	7
Over 40 years	6
	19
Color:	
White	13
Mulatto	2
Negro	4
	19
Sex:	
Male	18
Female	1
	19
Period of illness (very approximate only, in all series):	
1 month	1
6 months	1
9 months	1
18 months	1
2 years	3
3 years	1
6 years	1
19 years	2
"Some time"	1
"Long time"	1
"Do not remember when I was well"	1
"Always"	1
"Don't remember"	4
	19
Complications:	
Elephantiasis arabum	1
Malaria and tuberculosis	1
Pneumonia	1
Abscess of the liver	1
	4

(2) *Ponce series of 1902.*—These were 19 cases selected for uniformity of data and completeness from 100 studied that year in the Tricoche Hospital of Ponce, by Ashford and King.

Age:	
Under 10	1
Between 10 and 14 years	3
Between 15 and 24 years	5
Between 25 and 40 years	7
Over 40	3
	19
Color:	
White	13
Mulatto	5
Not stated	1
	19
Sex:	
Male	19
Female	None.
	19
Period of illness:	
2 months	2
3 months	2
8 months	1
10 months	1
18 months	1
1 year	3
2 years	2
3 years	3
4 years	1
6 years	1
8 years	1
"Don't remember"	1
	19
Complications, malaria	3

(3) *Utuado series of 1904.*—This entire series is available for a study of the clinical features of the disease and is very complete. There are 61 of these cases.

Age:	
Under 10	5
Between 10 and 14 years	18
Between 15 and 24 years	18
Between 25 and 40 years	18
Over 40	2
	61
Color:	
White	46
Mulatto	15
Negro	0
	61

Sex:	
Male	44
Female	17
	61
Period of illness:	
1 month	2
4 months	1
5 months	1
8 months	1
9 months	2
18 months	1
1 year	10
2 years	7
3 years	4
4 years	5
5 years	4
6 years	1
8 years	1
12 years	2
18 years	1
"Some months"	1
"Long time"	1
"Some years"	3
"Many years"	1
"Always"	3
Not defined	9
	61
Complications:	
Bilharziosis recti and bacteremia	1
Bacteremia	5
Bilharziosis recti, distoma hepaticum, and pellagra	1
Tuberculosis pulmonalis	2
Peruvian wart (?)	1
Malaria	2
	12

(4) *Rio Piedras series of 1906.*—There were 12 of the 22 complete enough to include in this group:

Age:	
Under 10	1
Between 10 and 14 years	1
Between 15 and 24 years	1
Between 25 and 40 years	5
Over 40	4
	12
Color:	
White	8
Mulatto	4
Negro	0
	12
Sex:	
Male	11
Female	1
	12

Period of illness:	
4 months	1
1 year	1
2 years	3
4 years	2
14 years	1
Not defined	4
	12
Complications	None.

Regarding the clinical type, the first two series were not classified, as were the others, according to the grade of the disease, but from these histories and those of 1904 and 1906 we have the following:

Clinical type:	
Ponce series of 1899—	
Very intense	10
Intense	6
Moderate	3
	19
Ponce series of 1902—	
Very intense	9
Intense	5
Moderate	5
	19
Utuado series of 1904—	
Very intense	17
Intense	36
Moderate	7
Light	1
	61
Rio Piedras series of 1906—	
Very intense	6
Intense	3
Moderate	3
	12
Summary of clinical type of the 111 cases—	
Very intense	42
Intense	50
Moderate	18
Light	1
	111

PRODROMES.

UNCINARIAL DERMATITIS OR "MAZAMORRA."

Before considering in detail the clinical features of uncinariasis let us preface our remarks by a short description of uncinarial dermatitis, the "mazamorra" of Porto Rico, a phenomenon which precedes by from two to four months nearly every case of uncinariasis, and generally, if not always, heralds the constitutional condition whose description follows.

The eruption is generally found between the toes and on the lateral and dorsal surfaces of the feet. Claude Smith's observation, that

walking in the mud causes it to be squeezed in between the toes and thus offers a better chance for infection, is borne out by the facts here. It must not be supposed that the feet, the usual site of infection, is the only one. It may extend even to the buttocks and, indeed, to any part of the body. We have often had histories of it on the hands of washerwomen and others; in one case infection occurred through the skin of the face. "Mazamorra" is a Spanish word whose use is corrupted by the jibaro. It usually means to them a separate and distinct disease of the feet, and they limit it to the phenomena attendant on uncinarial dermatitis. They declare it to be the penetration of the skin by "culebras," or little serpents, to be found in certain pools of stagnant water, decomposing vegetable matter, and mud. The distinction made by the jibaro between mazamorra and other forms of dermatitis of the feet is not made by the better classes. Mazamorra is understood by the latter to signify any dermatitis of the feet, although other and more elegant terms are used as a rule. We are unable to trace the exact application of the Spanish word to this affection, but as one of its correct meanings is "that which is left over at a meal," the "slops" in plain English, it carries with it the idea of putrefaction.

This invasion of the skin is especially feared by the coffee plantation "peon," not because he recognizes it as a precursor of anemia so much as that he knows that he will spend the night of the day of his exposure scratching, and if the infection has been sufficiently intense, in a few days his feet will be greatly swollen, red, brawny, and full of "water blisters," interfering with, if not entirely preventing, his work. The first evidence of infection is burning or prickling in the part which has been in contact with infested soil. Evidently the jibaro feels this first of all symptoms of infection, from the assurance that he gives that from certain specified pools and soft spots one may confidently expect to get mazamorra. Should he not feel this prickling a very few minutes after contact, he could never speak so authoritatively of acquiring it from definite puddles and wet spots. While all that has just been said will apply in heavily infested coffee estates, it can not be applied to the great number who suffer from casual, light infections. These, with a distinct recollection of having had mazamorra from time to time, can not associate their infection with any one spot.

The lesion is first erythematous, with much swelling, often with red lines extending up the leg; then papular; then vesicular. "Papulo-vesicular" is the term which should be used to describe typical mazamorra. Only on infection with pyogenic organisms do we find pustules.

Some connection, although as yet unproven by us, must exist between the very prevalent leg ulcer of the barefooted laborer, exposed to uncinarial dermatitis, and uncinarial infection. These ulcers are extremely stubborn. They are usually situated just above the ankle and are diagnosed by the uninitiated as "anemic," "syphilitic," "varicose," "tropical," and "chronic" ulcers. They are all about alike; not particularly fetid; superficial, with irregular unraised borders; covered with a sanious, not very purulent liquid, and accompanied by only moderate inflammatory reaction in the surrounding tissues. These ulcers last an almost incredibly long time, but are very

easily kept clean. One of us removed one of them by an elliptical incision quite near the borders, and found to our surprise that the ulceration only involved the skin and subcutaneous tissue. It was not at all adherent, and healing of the wound took place by primary intention. A still more peculiar feature is that these ulcers heal readily after a successful anthelmintic treatment.

Leg ulcers were noted in 6 of the Ponce series of 1899, in 3 of the Ponce series of 1902, and in 21 of the Utuado series of 1904, an average of 30 per cent of the 99 cases.

Loos, 1904, in an address delivered before the Sixth International Congress of Zoology, entitled "Die Wanderung der Ancylostomum- und Strongyloides-Larven von der Haut nach dem Darm," mentions the fact that apart from the route taken through the circulation to the lung larvæ may wander about the tissues without gaining the circulation for even as long as five years. He calls this the "creeping eruption." Is there some relation between this and the extremely obstinate leg ulcers above described?

Boycott and Haldane call attention to what they term "New Sump bunches," or "botches," which they state are very emphatically associated with ankylostomiasis in the mines of Dolcoath. These bunches are a cutaneous eruption resulting from contact with the earth or damp, rotting wood, and appear the same evening or the next morning after exposure, generally on the buttocks, knees, and forearms. As anemia in these mines became less frequent by reason of treatment and prophylaxis, the eruptions became correspondingly rarer and less severe.

They divide the skin affections into: (1) Furuncles of various sizes which start from a hair follicle; (2) urticaria which is not so frequent and which they attribute to a circulating poison emitted by the uncinariæ; (3) general pruritus without eruption. This is the rarest of the three.

These authors did not demonstrate the larvæ in the furuncles above mentioned. The pus was not eosinophilic.

BRONCHITIS.

Calmette and Breton ("L'Ankylostomiase," Masson et Cie., Editeurs, Paris, 1905), state that the skin lesions are frequently accompanied by an intense catarrhal bronchitis (catarrhe des gourmes) which may cause pulmonary emphysema. We have not yet been able to define this bronchitis in our cases.

THE ONSET OF UNCINARIASIS.

Very few people who suffer with this disease can clearly relate their first symptoms and the date upon which they were first noted. Uncinariasis is a most insidious disease, and "mal estar," or "feeling out of sorts," is about the nearest one can approach to what our patient first experiences. We believe that all who have seen much of the affection will agree with us that weariness, listlessness, and dyspepsia are the most constant symptoms first noted. The more abrupt acute forms, with melena, vomiting, and violent pains, are very rare. Pallor comes on afterwards. In fact, it should be borne in

mind that dizziness, edema, palpitations of the heart, pains in the body, and profound nervous symptoms often develop without any anemia whatsoever.

In Porto Rico the majority of those who harbor uncinariæ in large numbers do not remember when they really did feel well, as their infections are repeated so frequently and regularly as to make only unusually severe infections prominent in the midst of a long period of ill health. One might go further and say that there are many who never really knew what vigorous health meant and state that they were always well previously without analyzing their true condition. There is a diagnosis made by the laity in the interior which elucidates this strange mental attitude. Before the commission's campaigns here it was common, on asking the question, "Of what did your father die?" to receive the answer, "The natural death" ("la muerte natural")—that is to say, as closer questioning would reveal, of "anemia." The following were the answers given to us by the 19 cases of the Ponce series of 1902 in response to the question, "What were your first symptoms on falling sick:"

Serial No.
of case.

1. Pains head and chest, palpitations, and indigestion.
2. Indigestion, weakness, dizziness, and palpitations.
3. Weariness, palpitation, and indigestion.
4. Ulcer of the foot, pain in abdomen, weariness, and fever.
5. Slight loss of appetite, strength, and endurance. Quantities of blood in the stools.
6. Weariness, headache, bellyache, and palpitations.
8. Tinnitus aurium, edema of feet, pain in chest.
9. Dizziness, palpitation, gastric indigestion, and headache.
10. Palpitation, pain over heart, gastralgia.
11. Chills, fever, pain in head, chest, and abdomen, debility.
12. Pain in knees, weariness in chest, and dizziness.
13. Pains in head, chest, and stomach.
14. Pains in belly, chest, and legs.
15. Debility, fever, pain in body and chest, and uneasiness in stomach.
17. Does not know.
26. Dizziness, pain in chest, legs dead.
23. Debility, indigestion, constipation, palpitation, and headache.
51. Fever, chills, dizziness, and weariness.
52. Weariness in legs, arms, can not work.

It is perfectly evident after reading this list of "first symptoms" that the patient has often reached a pretty advanced stage of his disease before he realized that he "had something out of the ordinary."

Nevertheless, the salient points come out rather strongly as delineated at the outset of our remarks on "first symptoms."

CUTANEOUS SYSTEM.

PALLOR.

The pallor is not usually a mere whitening of the skin. There is almost always an icteric hue which rarely becomes true icterus. The color has been described as "lemon-tinted," "waxy white" to a "yellow" or "tan," "tallowy," "yellowish-green," etc. We prefer to describe it as dirty-yellowish or muddy. This is considerably modified by the normal complexion and, in mulattoes, a grayish, pasty

pallor is noted; in negroes a darker, ashen gray. We have seen a dead white skin in blondes. It is very rash to always judge of anemia by pallor. Aside from the remarks made under pseudo-anemia (see "diagnosis," report for 1904), we desire to call attention to descriptions of the pallor possessed by some of our patients, and found upon their histories, together with the actual hemoglobinometric readings taken later the same day:

"Not very noticeable"	Hb. 40 per cent.
"Little"	Hb. 39, 42, 50, 54 per cent.
"Pronounced"	Hb. 62, 65 per cent.
"Marked"	Hb. 58, 86 per cent.
"Slightly marked"	Hb. 24, 44, 47 per cent.
"None"	Hb. 43, 57 per cent.
"Relatively severe"	Hb. 58 per cent.
"Decided"	Hb. 74 per cent.
"Very pallid"	Hb. 70 per cent.
"Moderate"	Hb. 22, 32, 33, 34 per cent.
"Dirty greenish-yellow"	Hb. 62 per cent.

In general, however, the pallor is a fair superficial guide to the anemia present. The dirty-yellow complexion of the Porto Rican laborer has been noted by every stranger who has come to the island. The inhabitants of near-by islands have often referred to them in our presence as "the yellow people." The disease is known in Brazil as "the yellows" (Amarrellão).

Within the last few years, however, due to the intensive campaign carried on in practically all towns on the island, these marked cases of anemia have wonderfully diminished and visitors who ride over the roads communicating town with town no longer complain of the "starving anemics" they passed by the way. While this is true for the environment of towns and for a considerable strip on either side of the highways, we still have an unseen army of pale people hidden away in the mountains where coffee is grown. These are almost never observed by the tourist and casual visitor.

The proportion of our patients who presented this symptom with its degree of intensity may be demonstrated by notes on 146 Bayamon cases in the campaign of 1904:

No pallor	4
Slight pallor	17
Moderate pallor	30
Marked pallor	48
Extreme pallor	47
Total	146

Comparing this with the clinical type of 337 cases in Bayamon the same year, we have:

Slight cases	10
Moderate cases	71
Marked cases	193
Extreme cases	63
Total	337

Of these, 87 had edema, and 109 presented marked nervous symptoms. In fact, a profound anemia is not present in many cases with severe clinical symptoms.

The actual hemoglobin of 65 such cases was as follows:

	Persons.
Between 50 and 54 per cent	8
Between 55 and 59 per cent	10
Between 60 and 64 per cent	15
Between 65 and 69 per cent	10
Between 70 and 74 per cent	7
Between 75 and 79 per cent	6
Between 80 and 84 per cent	2
Between 85 and 89 per cent	4
Between 90 and 95 per cent	3
	65

Of the Ponce series of 1899, 18 were pallid, 16 markedly so.

Of the Ponce series of 1902, 18 were pallid, 1 was not.

Of the Utuado series of 1904, all were pallid, 1 slightly, 7 moderately, and 53 extremely.

Of the total number, 97 per cent were pallid; of 72 cases in which the degree of pallor was clearly expressed, 69, or 95 per cent, were very pale to extremely pallid.

In the Utuado series of 1904 the average hemoglobin reading on admission for each of the four grades of pallor noted is as follows:

Grade of pallor.	Number of patients.	Percentage of hemoglobin.
Slight	1	65.00
Moderate	7	41.14
Marked	26	24.70
Very marked to extreme	27	18.48

Inspection of the mucous membranes affords a better opportunity for making a rough estimate of the anemia present. Especially is this true of the conjunctivæ. If there is no inflammation present and care be exercised not to produce a compression of the vessels, practice will accustom one to more closely estimate the real hemoglobin percentage by pulling down the lower lid, than by forming one's judgment from the color of the skin.

Sometimes it is difficult to tell at a glance where the mucous membrane of the lip ends and the skin begins. The pallor is progressive; first the bulbar conjunctivæ become pale, then, little by little, the sac becomes gray, turning milky white or yellowish. Eventually all, or almost all, color disappears from the skin. The scleræ are a brilliant white or, in brunettes, bluish white (a point of distinction from malarial cachexia), and the patient looks more like a waxen image than a human being.

CYANOSIS.

In cases where the heart is seriously complicated, cyanosis is prominent, especially in the lips. In two cases of the Utuado series this was extreme.

The pallor of sclerotics, nails, and mucous membranes was particularly noted in the Ponce series of 1902: Mucous membranes of fair color, 3; pale, 15. Color of nails, fair, 2; pale, 4; very pale, 11. Sclerotics, white, 10; bluish white, 6; yellowish, 2.

PETECHIÆ.

They are observed at times in the middle-aged and the aged. This lesion was seen only once in our 111 special study cases.

GENERAL PRURITUS.

Pruritus without perceptible skin lesion was observed in 38 of 73 cases, or 52 per cent. It was not noted in the two Ponce series. As a symptom it is not worth much, as can be readily imagined, but, nevertheless, it can be considered a common phenomenon in the mild and moderate forms as well as in the severe.

URTICARIA.

Siccardi demonstrated this condition in his cases of infection by *Necator americanus*, and seems to suspect that it is a manifestation especially marked in infection by this species, in contradistinction to the disease as caused by ankylostoma duodenale, in which he never observed it. We can not remember any case which presented urticaria as a symptom in uncinariasis here.

LACK OF PERSPIRATION.

This is really a very prominent and common symptom complained of by patients in all stages of the disease. It is one of the symptoms which the jibaro will select to relate to his physician from among many others of perhaps much more importance. Many hail the return of perspiration after anthelmintic treatment as one of the best proofs of improvement, inasmuch as it had been almost or quite suppressed previously, even during hard work in the sun.

DRYNESS AND HARSHNESS OF THE SKIN.

This follows closely upon the preceding symptom and is, of course, its sequela.

Of the Ponce series of 1902, 9 were thus affected.

Of the Utuado series of 1904, 39 presented it.

Of the Rio Piedras series of 1906, all were observed to have dry and harsh skin.

Of 92 cases, therefore, 65.2 per cent were observed to have the skin unnaturally dry and harsh.

BURNING OF PALMS OF HANDS AND SOLES OF FEET.

This symptom, so prominent in Thornhill's cases, has been little mentioned. It was only recorded in the Ponce series of 1902, among whom nine stated that it was a clearly defined phenomenon.

ATROPHY OF THE SKIN.

This is really a very common phenomenon in severe cases, noted by Duprey (J. Trop. Med., Sept. 1, 1902). It still further deforms the natural lines of the face and contributes to the careworn, pitiable expression which has been commented upon by the lay visitor to the

Porto Rican mountain regions. This condition adds years to the face of a woman, and one of the most remarkable results of treatment was recovery of a texture of skin more in keeping with the age of the patient. It is by no means confined to the aged nor even to those of middle age, but is frequently found in children with a severe grade of the disease. No note was made of this condition in the Ponce series, but in the Utuado series of 1904 it was observed in 29. In 6 it was but slightly marked, in 16 well marked, and in 7 it was extremely prominent. One of the Rio Piedras series of 1906 also was observed to have it. In all of 73 cases, 41 per cent presented this symptom.

EDEMA.

To add to the weird appearance of the patient, edema of the face may supervene, distorting and blotting out normal facial expression. Edema, in general, is a late symptom when due to circulatory disturbance, but this condition must not be confused with the frequent edema seen quite unexpectedly throughout the earlier stages of the disease.

The following is a classification of our edematous patients in Bayamon whose hemoglobin was taken. The percentages are arranged in groups of 10:

Hb.	Persons.
Below 20 per cent	7
Between 20 and 29 per cent	22
Between 30 and 39 per cent	23
Between 40 and 49 per cent	12
Between 50 and 59 per cent	4
Between 60 and 69 per cent	7
Between 70 and 79 per cent	2
Between 80 and 89 per cent	2
Total	79

Edema of the lower extremities is to be found in nearly all extreme cases, first in the feet and ankles, then in the legs, next in frequency in the face, where it appears chiefly in the eyelids and cheeks. It tends, finally, to extend throughout the whole body. It often involves the scrotum, which may become enormously swollen.

To illustrate what extremes may be reached, we may call attention to a case in which the whole body was water-logged. She could not walk, could not see, the eyelids looking as if dry cups had been applied, and when her pulse was taken the impression of the whole hand was left deeply sunken in the enormously swollen wrist; yet she recovered and became perfectly well, rosy, and fat, running from 20 to 98 per cent hemoglobin. But edema often results from a remote cardiac lesion, due to fatty degeneration or valvular sclerosis, consequent upon some previous attack of uncinariasis. We had such a case, an old man with 65 per cent hemoglobin, almost as edematous as the above cited. He lingered 55 days, had no uncinariæ after his second week of treatment, and died of valvular disease of the heart, a sequela of uncinariasis. The urine was examined for albumin in a number of our most edematous cases with negative result, and we were unable to demonstrate that it was due to nephritis.

In the Ponce series of 1899, 8 were edematous, 3 intensely so. The lower extremities were affected in 4, both upper and lower extremities in 1, and 1 had general anasarca.

TYPICAL FACIAL EXPRESSION OF THE SUFFERERS.

In the Ponce series of 1902, 15 were edematous. Two had edema of the feet alone, 4 of the feet and legs, 4 of the face, feet, and legs, and 5 had general anasarca.

In the Utuado series of 1904, 50 were edematous. Twenty-one had edema of the lower extremities, 8 of the face and lower extremities, 4 of the face, upper, and lower extremities, 3 of the face alone, 1 of the face and upper extremities, 1 of the face and trunk, and 12 had general anasarca. Eight of the 50, apart from the cases of anasarca, were noted as having been very extreme. Nine had no edema, and in 2 cases there was no remark made upon this symptom.

In the Rio Piedras series of 1906 all had edema, 7 of the lower extremities and 5 of the face and lower extremities.

Therefore, of 111 cases (it is true, marked or very marked in over 90 per cent) 76 per cent suffered from edema.

As a matter of fact, however, in the out-patient clinic only severe cases were edematous, as a rule, with notable exceptions, as above stated. The edema which we saw in patients who were not very anemic was, as a rule, fleeting.

GENERAL DEVELOPMENT.

Uncinariasis of childhood is a potent cause of retarded development and of stunted mental and physical growth thereafter. We have often been deceived in the true age of an individual, persons of 20 years seeming to be of 12 or 15. Puberty is often delayed. In males the genital organs may be undeveloped and the hair of the body lacking. In females, menstruation, which occurs here much earlier than in the more temperate climates, may not make its appearance until the age of 18 to 20. We have known cases where children have been born of mothers who have said that they have never menstruated. More than all, many children born of anemic mothers are rachitic and are little resistant to disease and hardship.

Among the 100 cases studied in Ponce, 19 of which form part of the basis for a special study of the symptomatology, there were 4 cases of special mention regarding development:

Case 8, 11 years of age, "was stunted mentally and physically."

Case 18, 16 years of age, "has matured but little and appears to be from 8 to 10 years old."

Cases 81 and 83, each 18 years of age and each with the following remark: "Very much stunted mentally and physically. Looked to be about 10 years of age. Genitals infantile type."

In the 1904 Utuado series six are noted as having defects in development.

NUTRITION.

The nutrition is generally good.

In the Ponce series of 1899, 7 were well nourished, 1 fairly so, 3 were not very well nourished, and 8 were emaciated. In this series the average poor nutrition was in part due to lack of food and privation incident to the hurricane.

In the Ponce series of 1902, 13 male adults, averaging 66 inches in height, showed an average of 129.2 pounds weight. Two others were not weighed and the rest were children.

In the Utuado series of 1904, 51 were well nourished and only 9 were emaciated. In 4 of the latter the emaciation should be explained by concomitant diseases.

In the Rio Piedras series of 1906, 3 were emaciated.

In the moderate grades of the disease, the flesh is flabby, but not doughy. Later in the course of the affection, when anasarca ensues, no correct estimate as to amount of flesh can be made save in very general terms, and, indeed, some of the cases above cited were subjects of anasarca. Emaciation, however, is not a usual phenomenon in uncinariasis, and when it occurs, it is likely to be due to intercurrent diseases, starvation, or severe digestive disturbances, as above noted.

While the weight of an average case does not suffer greatly, it is certainly true that these patients are, as a rule, underweight, for they almost always gain well upon treatment.

The average weight of 100 grown men, according to Sandwith, with an average of 65.5 inches in height, on admission was 117.5 pounds. Of those who remained in hospital over two weeks, 70 per cent gained in weight, 22 per cent lost, and 8 per cent remained stationary. Average loss, 3.2 pounds; average gain, 5.4.

MUSCULAR SYSTEM.

There is a tendency to ready fatigue of muscles, and patients tire easily. The muscles are flabby and the seat of a dull ache. This weakness may reach an extreme grade with soreness, and, indeed, may roughly simulate paralysis, a condition readily excluded by careful examination. Attention is called to cases 24 and 25 of the Ponce series of 1902. Both of these patients were so very weak as to be utterly prostrated. Case 25 caused us a great deal of trouble in diagnosis, as it seemed very possible that the man might be afflicted with a complicating peripheral neuritis, given the history. It is interesting to note that he had also a tremendous hemic murmur and profound anemia. This case, however, was merely a severe form of uncinariasis with exaggerated muscular debility, as the prompt result of anthelmintic treatment proved. Every now and then some one reads a paper announcing the presence of beriberi in Porto Rico, but each time these reports have been refuted with great ability by some Porto Rican physicians who know what beriberi is. This latter disease does not exist, we believe, in this island, and such cases are to be generally considered uncinariasis of severe type.

Debility is one of the earliest symptoms and is very constant throughout the course of the disease and in all grades. When asked in the clinic why he sought medical advice the jibaro would usually reply, "Because I can not work," an evidence not only of the constancy of the condition under consideration, but also a refutation of the sly accusation implied in the name recently applied to uncinariasis, "the lazy disease."

Weakness was a universal complaint among our 111 special cases, but it was especially notable in 17 of the Ponce series of 1902, and in 53 of the Utuado series of 1904, in which latter series debility was extreme in 1 and very marked in 38. No special note was made of the degree of debility in the Ponce series of 1899 and the Rio Piedras series of 1906.

SHOWING STATE OF NUTRITION IN SEVERE CASE REPORTED BY DR. ROSES ARTAU.

In the Utuado series of 1904, 27 complained that their muscles were sore; 49, that they were painful, either an aching pain or pain on movement; and 53 had flabby muscles, percentages of 44, 80 and 86, respectively.

Pains in the body are spontaneously complained of by most uncinariasis patients. This symptom is at best unsatisfactory. The patient calls it rheumatism, but rheumatism is not nearly so common in Porto Rico as is generally thought. We prefer to look upon these pains as due to overfatigue of muscles.

In the Ponce series of 1902, 7 complained of pain in the chest (not "heart pains"), and 14 of pains in the legs.

In the Utuado series of 1904, 26 complained of pain in the chest, which was slight in 5, marked in 16, and very severe in 5. This is often a true bone ache of the sternum. The fact is, however, that some pain in the sternum is made the subject of complaint by nearly every case which is at all well marked and in some where it is one of the very few symptoms present. Indeed, pains in the chest and body is a common complaint from the onset of the disease.

Weakness and actual pain in the knees is a symptom of which many are accustomed to complain.

TEMPERATURE.

Fever at the outset of the disease is probably a fairly constant symptom. In the clinic fever was very rarely observed in the slight and moderate cases. In fact, the tendency was quite in the other direction, for the patients, when questioned concerning their bodily temperature, generally stated that they felt cold most of the time, and this was easily corroborated by touching their skin.

But with astounding frequency a slight to moderate rise in temperature is demonstrable at times in the course of severe cases, the "anemic fever" of older authors. This fever disappears on anthelmintic treatment and is replaced by a subnormal temperature.

In the Ponce series of 1899, 11 had fever on admission, all save one with but a slight rise.

In the Ponce series of 1902, 5 showed a rise in temperature.

In the Utuado series of 1904, 29 had a temperature ranging from 37.5 to 39 and 3 above 39.

Three of the Ponce series of 1899, 3 of the Ponce series of 1902, and 4 of the Utuado series of 1904 had at the same time intercurrent diseases which commonly cause fever. Deducting, therefore, these 10 cases, there were 38 of the 99 cases which presented on admission to hospital a rise of temperature whose cause could not be determined by any discoverable condition. This latter statement should, however, be modified in view of certain discussions which have arisen concerning the pathogenesis of uncinariasis. In the first report of the Porto Rico Anemia Commission, December 1, 1904, we find, on page 91, under the heading "Pseudo-rheumatic affections," the following:

> What may prove to be a serious condition in Porto Rico is the invasion of the blood by a bacillus. All mention of a bacillus in the blood in our special cases has reference to this organism. It was first noticed by Dr. Gutierrez on June 9, while examining a specimen of case 41, special Utuado series, and large numbers of this bacillus were constantly present in additional examinations of

the blood of the ear and the serum of the feet. She was then suffering with great edema, fever, and rheumatic pains. A pure culture, made under rigid precautions, was subsequently found to be the same as others taken from individuals suffering from a like set of symptoms, irrespective of anemia. In one case there was 91 per cent of hemoglobin and decided edema almost reaching anasarca, with fever and joint pains. In all these cases neither albumin in the urine nor heart lesion could be found. We have seen curious instances of localized edema with fever in persons not infected with uncinariæ and of good station in life, where the same bacillus (morphologically) was found. Case 44 of the series reported in American Medicine, September 5 and 12, 1903, had a fusiform edema of both legs not extending to the ankles, which greatly puzzled us. It disappeared after a time. The commission is not prepared to give its classification. We are indebted to the laboratories of the Army and the Public Health and Marine-Hospital Service for assistance in studying this microorganism.

The organism in question was, according to the late James Carroll, major, Medical Corps, United States Army, on the one hand, and Rosenau, of the Public Health and Marine-Hospital Service, on the other, nothing more or less than one of the colon group. Ferguson, British Medical Journal, 1907, ii, 1320, states that the bites of the parasites in the intestines cause little foci of infection in the mucosa and chronic inflammation.

As in 6 of the 28 Utuado cases presenting fever not manifestly due to some intercurrent disease we were able to demonstrate the presence of the bacillus, which later proved to belong to the colon group, in the circulating blood, we offer this as one, at least, of the causes for febrile movement in uncinariasis.

DIGESTIVE SYSTEM.

The series of symptoms pertaining to the digestive tract are not nearly so prominent in a well-marked case of uncinariasis as are those of the circulatory and nervous systems. For this reason they are apt to be too hastily passed over by patient and physician; but, although at times indefinite, a fairly clear history may be usually elicited. The period of marked digestive symptoms is normally found at the inception of the disease. The patient may forget to mention them and the physician to ask about them when other and more serious developments arise in the involvement of other systems.

In this connection it is of the highest importance to emphasize an atypical form of uncinariasis which more frequently than any other puts the physician to confusion in his practice in these tropical countries. This is the dyspeptic form of the disease. There are a great number of persons, and more frequently those accidentally infected whose position in life is good, who for a long time have suffered from what they themselves diagnose "dyspepsia;" most unfortunately for them their physician chimes in with their diagnosis. There are a large number of so-called "gastrites," "hyperchlorhydrias," and even "gastric ulcers" that may be permanently cured by thymol after an examination of the feces. Ashford admitted a soldier to hospital with as clear a history of gastric ulcer as one would wish, with pain an hour after eating, vomiting of a considerable amount of blood on several occasions, and a tender spot just to the right of the middle line in the epigastric region. This man had many uncinaria ova in his stools and (whether he really did or did not have a small ulcer or ulcers) promptly became perfectly well after three doses of thymol,

without special diet or other drugging. Another case, that of a child of well-to-do parents, was carried from physician to physician, each one of whom treated him for "dyspepsia," until ova of uncinariæ were discovered in the stools, and one dose of thymol literally cured him. Such masked cases rarely have any other symptom to attract the attention.

THE APPETITE.

Generally there is increased appetite, often reaching bulimia in the moderate and marked cases, but in the last stages there is frequently complete anorexia.

Apart from the nature of the food, the jibaro wants bulk. He does not want meat and concentrated foods, no matter what the layman may say of his present bill of fare. He does not care for a diet of cream, roast beef, and other concentrated foods nearly so much as for "mafafo," or a poor class of bananas; "bacalao," or dried codfish; "arroz," or white rice; and "habichuelas," or beans. While he will eat with avidity almost anything, he must have something that is filling ("algo que le llena"). It is a modified form of geophagy. Anyone who has been in attendance for any length of time at the municipal hospitals knows that this is true. He needs to fill his stomach fuller than we fill ours. Of course, easily digested concentrated food would be better for him. His proteid ration is extracted at a greater expense to his gastric and intestinal digestive apparatus from vegetables and grains than it would be from meats. We have heard them plead for a plate of "mafafos," etc., when we had seen the ample and nutritious hospital meal they had just eaten. We explain this phenomenon by the fact that there is a perverted appetite; that the stomach craves, perhaps from the irritation of these minute worms or from other consequences of infection, to be stuffed just as is demonstrated in this universally well-known sign of other intestinal worms. Gastric dilatation is often the result and is dependent upon the irritating and indigestible nature of the food, upon its enormous bulk, and its characteristic tendency to produce flatulence. The intestinal functions are labored and the bowel distended and often partially paretic for short periods. There is no doubt in our minds, however, that this stuffing of the bowels with enormous quantities of food, with the results of this habit, is a potent factor in sustaining and augmenting any direct inflammation caused by this little nematode.

From this it is but a step to true geophagy, at times perhaps a source of infection, but more properly considered a symptom. "Geophagia" or "allotriophagia," as the disease has been called, is not a symptom of uncinariasis alone, but occurs in chlorosis, in pregnancy, and in the presence of other intestinal worms. We formerly believed this to be a symptom mainly confined, in Porto Rico, to children, but in one form or another it is found in many adults. Save in children, the eating of mud is not nearly so common as the eating of raw rice, coffee, corn, and vegetables. We know of one case where cigar ashes were eaten. It is known as "el vicio," the vice, among the country people. We had one case in hospital, an old negro, who reached camp in a pitiable condition from uncinariasis. He was all doubled up and very weak, crawling from place to place on hands and knees. This

man, to gratify his inordinate appetite for earth, used to elude all vigilance and painfully crawl away to some distance in a neighboring field, where he would satisfy his craving and howl for the nurse to carry him back to his bed. We expelled most of his uncinariæ, and were obliged to send him home on account of this and other filthy habits. To our surprise, we later met him in the streets of Utuado, walking upright and wonderfully improved.

Besides earth the patients may consume plaster, feathers, paper, unripe fruit, charcoal, etc.

Only 2 of the Utuado series of 1904 confessed to geophagy.

In the Ponce series of 1902 the appetite was good in 10, capricious in 8.

In the Utuado series of 1904 the appetite was good in 47, capricious in 2, and poor in 8. In addition to these, 3 suffered from absolute anorexia and 1 from bulimia.

In the Rio Piedras series of 1906 the appetite was good in 7, poor in 5.

Of the total number (92), 64 had a good appetite, or 69.5 per cent; 10, or 10 per cent, had a capricious appetite; and in 13, or 14.1 per cent, it was poor.

TONGUE.

The tongue is pale, often has a whitish coat, is enlarged and tooth-indented. At times it is partially denuded of epithelium, red and raw. A peculiar and often-mentioned symptom is the presence of two purplish smears, one on each side of the central line, making it appear as if a pencil had been sucked. It was first reported by Delamere. (J. Trop. Med., Nov. 1, 1902.) These are engorged veins, and when seen, which is not very common, are circulatory phenomena. Three such cases occurred in our Utuado series of 1904, or 4.9 per cent. This sign should be distinguished from the pigmented spots on tongue and buccal mucous membrane, seen in two of our Utuado series. They are from 2 mm. to 4 cm. in diameter and are apt to be found in patients of a mixed race. We could not establish any clear connection between these spots and the disease.

CATARRHAL STOMATITIS.

This is sometimes present. It may be very severe, as in one case at Utuado, an old negro woman, where it had denuded tongue, gums, and buccal mucous membranes, extending over the lips to the skin line. It is a very inconstant phenomenon and seems to be associated with severe gastritis, when it does not depend on some local condition.

Of the Ponce series of 1902, 6 had it, or 31 per cent, but the condition was not carefully recorded in the other series.

SALIVATION.

This is a frequent phenomenon, reaching at times a marked grade. It occurred in 9 of the Ponce series of 1902, a percentage of 42. This symptom was not carefully recorded in the other series.

FLATULENCE AND HEARTBURN.

These are very common symptoms and are referable to the dyspepsia present.

Flatulence occurred in 46 of the Utuado series of 1904 and in 3 of the Rio Piedras series of 1906, a total of 49 in 73 cases, or 67.1 per cent.

Heartburn occurred in 15 of the Ponce series of 1902, or 78.9 per cent. It was not recorded in the other series.

WEIGHT AND FULLNESS IN THE EPIGASTRIUM.

This is an extremely common symptom and is generally brought to the attention of the examining physician by the jibaro, who remarks that he feels as though his stomach was always "occupied" ("ocupado"). There is apt to be some puffiness over the epigastrium.

It was noted in 16 of the Ponce series of 1902, or 84.2 per cent, but not in the others.

NAUSEA.

Of the Ponce series of 1899 nausea was present in 5 and was of moderate intensity.

In the Ponce series of 1902 it was present in 11.

In the Utuado series of 1904 it was present in 39, of which in 7 it was but slight and in 1 severe.

In the Rio Piedras series of 1906 it was present in 6.

Thus, in a total of 111 cases nausea existed in 61, or 54.9 per cent.

Although these figures show it to be a frequent symptom, as it is in the severe cases of which these are representative, in the clinic nausea is rather an infrequent symptom. It may be due to gastric conditions or it may be an accompaniment of the dizziness, weakness, and tendency to syncope so often observed.

VOMITING.

This is rarer, but has been present in several cases, with marked dilatation of the stomach. It may occur independently of gastritis, as does nausea, from a tendency to faint. Vomiting of blood should raise a suspicion of gastric ulcer, but this symptom should not be absolutely depended upon, as before demonstrated.

Vomiting occurred in 3 of the Ponce series of 1899; in 7 of the Ponce series of 1902; in 27 of the Utuado series of 1904, among which 2 were severe and 5 slight; and in 4 of the Rio Piedras series of 1906.

Of a total of 111 cases, therefore, 41, or 36.9 per cent, suffered from vomiting.

This symptom, as in the case of nausea, is a still more infrequent one in the clinic.

PAIN IN THE EPIGASTRIUM.

This was noted in 8 of the Ponce series of 1902; in 51 of the Utuado series of 1904, 7 of which had only slight pain and 2 very severe; and in 6 of the Rio Piedras series of 1906.

Of the 92 cases, 65 suffered from gastralgia, or 70.6 per cent. All authors give prominence to this and the following symptom:

TENDERNESS IN THE EPIGASTRIUM.

This was noted in 11 of the Ponce series of 1902; in 30 of the Utuado series of 1904, of which it was slight in 3 and very severe in 16;

and in 3 of the Rio Piedras series of 1906; a total of 44, or 47.8 per cent.

Pain and tenderness in the epigastrium is one of the most prominent symptoms of the earlier stages and lighter grades of the disease, but later becomes so overshadowed by the serious developments of the severer grades as to lose its importance for the patient. The physicians must therefore inquire of the sufferer in the later stages of uncinariasis for a symptom which in the earlier stages or lighter grades of the disease the patient himself would have undoubtedly mentioned. This statement should be taken also to cover practically all gastro-intestinal phenomena of uncinariasis.

There may be only a weight and fullness, or there may be a throbbing or burning or a sharp lancinating pain, at times relieved by taking food. The pain and tenderness is often located in the right hypochondriac region and seems to be due in some cases to the irritation caused by the worms. In others it is merely the expression of a gastric or intestinal fermentation and catarrh. The theory that this pain is due to the change of position of the worms at time of coitus seems to us remarkably far-fetched. Surely the chronic inflammation of the stomach and upper intestines would explain these sensations without such a fanciful explanation cited by so many authors, notably Lutz. Equally unusual is localized peritonitis due to underlying, deeply fixed uncinariæ. We have never seen this peritonitis of which Lutz writes.

DILATATION OF THE STOMACH.

This is fairly common. There were 3 in the Ponce series of 1902 and 1 in the Utuado series of 1904 suffering from this condition. The latter case was a very severe one, but gastric dilatation is much more common than this, as only the severe cases are noted.

METEORISM.

A greater or less degree of tympanites may be generally observed. It is the result of illy-digested starches, as a rule, and may reach a very severe grade, interfering with breathing or producing a chronic "pot-belly," a not unfrequent sign in children. The peasant, we again repeat, has a most bulky food. In order to obtain sufficient nutriment for his bodily needs, he has to consume enormous quantities of protein-weak food within his reach, plantains, tubers, etc., and these set up fermentation in the intestine, the seat of pathologic changes, giving rise to quantities of gas.

Meteorism occurred in 5 of the Ponce series of 1899, in 12 of the series of 1902, in 37 of the Utuado series of 1904, of which 2 were slight and 2 very marked, and in 3 of the Rio Piedras series of 1906. Of 111 cases, 57, or 51.3 per cent, suffered from this symptom.

ENTERALGIA.

It was present in 6 of the Ponce series of 1899, in 9 of the Ponce series of 1902, in 30 of the Utuado series of 1904, and in 4 of the Rio Piedras series of 1906, a total of 49 of 111 cases, or 44.1 per cent.

Enteralgia was not usually severe. In the general clinic, strange to say, it was rarely a prominent symptom.

ABDOMINAL TENDERNESS.

This was observed in 8 of the Ponce series of 1902, in 39 of the Utuado series of 1904, of which 2 were slight and 7 very severe, and in the Rio Piedras series of 1906 in 5, a total of 52 of 92 cases, or 56.5 per cent.

In the 8 cases of the Ponce series of 1902 the tenderness was greatest over the umbilicus in 3, above the umbilicus in 1, below the umbilicus in 1, in the inguinal regions in 2, and general in 1.

BOWELS.

In the Ponce series of 1899, 9 suffered from constipation, 1 from diarrhea, and 1 from alternating diarrhea and constipation.

In the Ponce series of 1902, 12 suffered from constipation, 2 from diarrhea, and 2 from alternating diarrhea and constipation.

In the Utuado series of 1904, 20 suffered from constipation, 4 from diarrhea, 8 from alternating diarrhea and constipation, and 29 had normal movements.

In the Rio Piedras series of 1906 constipation was seen in 4, diarrhea in 5.

Thus there was a total of 45 cases of constipation, or 40.5 per cent; of 12 cases of diarrhea, or 10.8 per cent; of 11 cases of alternating diarrhea and constipation, or 9.9 per cent.

In the clinic diarrhea is comparatively rare, constipation rather common, but usually the jibaro states that he is "corriente;" in other words, "all right," or normal.

In general the bowels are normal or constipated in the early stages of the disease and in all save the severer grades. Exception should be made of the form called by Manouvriez "forme aiguë abdominale," in which he states that diarrhea is very marked. We do not remember to have seen this form sufficiently to permit us to dignify it by a separate designation in our classification of the disease. Diarrhea is usually a symptom of the severe grades and often presages death. It becomes dysentery in its terminal forms and is a formidable complication.

FECES.

Little may be learned from a macroscopic examination of the feces. Blood, macroscopically, is rarely seen. Of over 22,000 specimens of feces brought us in 1904 for examination only 6 contained blood, and 5 blood and mucus from a naked-eye inspection.

Neither is it a prominent feature microscopically, although more frequently seen. It should be remembered that bilharziosis of the rectum was of much more frequent occurrence than appears from this report. Mucus in the stool was not common, but undigested food was frequently observed. Blood in the feces is said to be a common condition when the worms are changing position while young in the intestine. Stiles recommends to those who do not possess a microscope, as a "rough test" for uncinariasis, that feces be placed on a piece of white blotting paper. He says: "It leaves upon the paper a reddish-brown stain similar to a bloodstain." This we only mention to condemn as a most dangerous guidepost. It has been on frequent occasions a source of surprise to Stiles and others that we do

not ordinarily find blood in the stools. We can not emphasize too strongly that after hundreds of thousands of examinations of feces by the collective work of physicians in every town in the island, and microscopic examinations at that, blood in the stools was found to be a rarity. There is nothing in all that happens to the average jibaro that will bring him to the physician in abject terror with greater promptness than hemorrhage of any sort, and thousands have testified to us personally that they have never seen blood in their stools. As to occult hemorrhages, we know that blood is consumed along with the cells of the mucous membrane, first demonstrated by Looss and afterwards corroborated by ourselves, and we never even took the trouble to look for occult blood. This for the very simple reason that we knew that it was there. Had a feasible quantitative test been available it would have been tried. It may be of interest to note, however, that feces of the laborers in Porto Rico are not of the color of digested blood. They are normal or light in appearance and entirely consistent with the food of the country—a pretty fairly unchanging bill of fare. We earnestly recommend the abandonment of this "rough test." An apparent positive result would add to a rough test a far rougher, perhaps serious error, in a dysenteric patient, and dysentery is only one of the many much more common causes in the tropics, at least, of blood in the stools, occult or otherwise. Such a patient might be administered to his undoing, from violent purging, one of the three drugs which we have been able to show are, in inflamed states of the bowel, powerful intestinal irritants.

Boycott and Haldane state:

> In no case could any history of melæna be obtained, and in none of the samples of feces examined was the color suggestive of bleeding into the alimentary canal.

In Siccardi's first four cases hemic crystals were repeatedly and carefully sought but found in only one case. Spargella had the same experience and adds that one would certainly expect to find some occult blood if sufficiently delicate tests were employed. Neither of these authors regard hemorrhage into the intestinal canal as a potent source of anemia in this disease. Spargella was unable to find blood even by spectroscopic examination in three of his four cases.

Dr. R. Fisch, mission physician, Aburi, Gold Coast, Africa (Archiv. für Schiffsund Tropen-Hygiene, No. XII, 1908, Leipzig), says:

> Veränderte Beschaffenheit der Stühle, makroskopische oder mikroskopische Beimegung von Blut habe ich nie beobachtet, wo reine Uncinariasis vorlag * * * Auf keinen Fall halte ich den Nachweis von Blut im Stuhl hier für beweisend.

All of this does not mean that blood does not occur in the feces, but for the benefit of those who consider direct loss of blood from the small bites of the worm in the intestine the chief, or at least an important cause of the anemia, we affirm it to be the experience of the physicians who have been working under our direction at the many uncinariasis stations throughout the island that blood in the stools as a result of uncinarial infection is really rare, as a macroscopic phenomenon; still unusual microscopically, in quantity sufficient to constitute hemorrhage; and not presumably abundant transformed chemically, owing to the usual normal color of the feces.

In two of our Utuado series of 1904 blood was found in the feces, but this only once in each case after the course of repeated weekly examinations. In 47 the feces were normal in appearance, microscopically; 7 contained a good deal of mucus, 2 had entirely undigested food, and 2 were unnaturally dark in color.

Mosler and Peiper give us interesting information. They say that blood in the stools was not a common event in the St. Gothard tunnel epidemic.

It is perfectly safe to consider loss of blood one of the contributing factors to the anemia. Any parasite whose hold on the mucous membrane is such as that represented in the micro-photograph (pls. 23 and 24, p. 189) of the worm in situ, must draw some blood into his intestinal canal at times, even though his normal food be the covering cells of the intestinal wall. That from time to time a small vessel is opened and hemorrhage results is also evident from the testimony of good observers. But that the worm should be termed "a blood sucker of the worst type" and the anemia considered to result from direct loss of blood is certainly open to question.

When *Necator americanus* is thus described we imply that its nourishment is chiefly or entirely derived from the blood of its host, and once this is accepted the anemia has a plausible explanation. But, as a matter of fact, our findings at autopsy, performed generally a considerable time after death it is true, but in some cases as early as two or three hours, usually revealed white or gray worms, not filled with blood. We quote in this connection a paragraph from Observations on the Campaign against Uncinariasis in Porto Rico (Boston Medical and Surgical Journal, Vol. CLVI, No. 14, Apr. 4, 1907, p. 417):

> In our 12 autopsies of this year (1905) and those of the last, we have only once seen the rose-red ecchymoses described in the older works as occurring in the jejunum. In all save this one it would have been very difficult indeed to have found the point of attachment of a worm after it had become detached.
>
> In the case we were able to see the little red points, which were very small and only noticeable by holding the cleaned intestine against a good light and looking through it, the patient had not received any specific treatment. This case was the only one in this year's series in which no anthelmintic had been administered. Had we not held the intestine up to the light we probably would not have noticed these spots. A number of them were removed and were found to present very minute and superficial erosions with no invasion of the submucous tissue.

We are fully aware of the discordant note we are sounding in stating our position regarding the pathogenesis of uncinarial anemia. Future investigations, perhaps autopsies performed sooner after death, may modify these views.

We have not had many autopsies as yet, but we have been unable to accept hemorrhage as the chief cause for this anemia from evidence we have so far collected.

In view of the conflicting testimony so far presented we hope to make this the object of a special study in the future.

CHARCOT-LEYDEN CRYSTALS.

These are very frequent in the feces of a patient infected with uncinariæ. Sometimes they are found in enormous numbers. They

are a valuable sign when ova of uncinariæ are not readily found, although they are observed in the presence of other intestinal parasites. We have not been able to establish any clear relation between their abundance and eosinophilia. An inspection of our Utuado cases will reveal this fact.

Of the Ponce series of 1902, 11 had Charcot-Leyden crystals; in the Utuado series of 1904, 35 had them; in a total of 80 cases, 46, or 57.5 per cent, had these crystals in the feces.

OVA OF UNCINARIÆ.

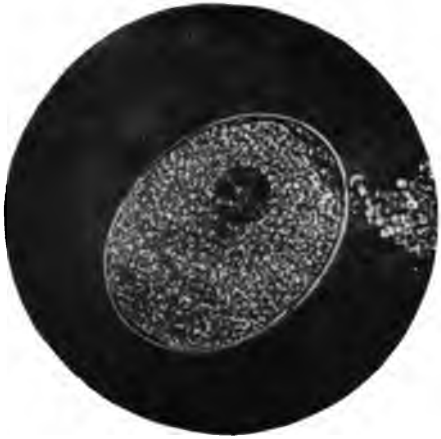
We have evidently been dealing with very heavy infections here. One reading the reports of the disease in other countries is struck with this fact. Especially to be noted in this regard is the tendency to diagnose "uncinariasis" because ova of the parasite are found in small number in the feces. Maj. W. P. Chamberlain, of the Army, reports 60 cases of a hundred southern soldiers examined, under the title of "The prevalence and importance of uncinariasis among apparently healthy southern-bred white men in the United States Army." Few, if any, of these cases would be considered anything but very light infections in Porto Rico, if, indeed, such light infections could be often found. The total number of uncinariæ expelled by anthelmintic treatment in these 60 cases was 1,041, less than many of our individual cases contained. He thoroughly understands the fact that no consequent symptoms could be expected in such light cases and writes from a prophylactic point of view, but we wish to emphasize to all who might gather the idea that uncinariæ do not constitute a particularly great menace to health, that we can not look upon these cases as cases of uncinariasis but as instances of infection by uncinariæ; in other words, they are worm carriers, not worm sick.

These light infections are the ones that have undoubtedly prompted some medical officers in India and physicians elsewhere to deprecate the idea that uncinariæ are a source of general invaliding of labor. As a matter of fact many very light infections do (subtlely, it is true) influence the quality of labor, as a careful perusal of Chamberlin's cases will demonstrate.

Twenty ova to a field (one-third objective, 4 ocular, Leitz), was common in our experience, and we have often seen more than this, even to a hundred. Rare is it that the first field does not disclose one. Compare this with Chamberlin's conclusion, "In many light infections the ova are difficult to find, requiring the complete examination of five or six cover-glass preparations."

Leichtenstern's method of estimating the number of female parasites from the number of eggs is to divide the number found in a gram of feces by 47.

Lutz made a 25 per cent suspension of the feces in water and counted the eggs in a square centimeter into which the slide was divided. This square centimeter held 4 milligrams of the liquid, or an equivalent of 1 milligram of feces. This amount is multiplied by the weight in grams of the daily amount of feces expelled. It is said that 6,000 ova are the normal output of each female in a day.



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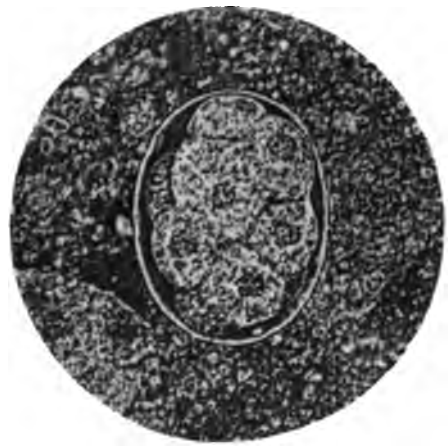

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6.

STAGES OF DEVELOPMENT OF OVUM OF NECATOR AMERICANUS.

Photographed by Dr. Wm. Gray, Army Medical Museum, and contributed by him to this work.

Grassi and Parona state that 150 to 200 ova per centigram of feces indicate 1,000 uncinariæ—750 females and 250 males.

These calculations are, however, easily upset. We soon found that it was impossible to commit to figures a calculation of the number of uncinariæ harbored by the host from the number of eggs found in the stools. In a very broad sense we could say, saving accidents, of which we will speak later, that a person had a few, a moderate number, or many parasites; and thus our examinations of the feces are recorded, as a rule, not by numbers per field, but in a general sense, after observation of several fields, as "few," "moderate," "many," "great many." And this is as close, we believe, as one can come to guess the number of worms from the number of eggs in the feces. Even this is extremely fallacious. We very soon found that it was much more difficult to find ova in a diarrheal stool. Dieminger states that not only does diarrhea greatly reduce the number of ova, but that a drinking bout will cause them to well-nigh disappear from the stools in which before they had been abundant. This same result, he adds, may be produced by the eating of herring. A suspended ovulation is suggested. In the severe cases here, however, neither alcohol nor dried codfish, or apparently anything else, seems to entirely suspend ovulation.

Siccardi completely discredits any attempt at an estimate of the number of uncinariæ from the number of eggs in the feces. We cordially unite in supporting his statement, demonstrated by our Aibonito cases in 1905. No more shifting ground can be assumed than that one can judge of the number of uncinariæ inhabiting an intestine, save in a general way. And why should we "mortify the spirit" in a work which should be practical and yet as scientific as we can make it, by adopting standards which can not in truth be sustained.

All that has been said for the numerical valuation of uncinariæ by a "scientific guess" from the ova in feces will apply to any proportion fixed for the relative number of males and females. Our own observation is that such estimates, save in a most general way, are valueless and further invalidate results of attempts to calculate the number of uncinariæ harbored. As Siccardi says, the diverse proportions fixed by well-known authors demonstrate this statement.

CIRCULATORY SYSTEM.

The disturbances caused in the circulatory system are among the chief sources of suffering and invaliding of the patient.

THE HEART.

The protean nature of the symptoms and the physical signs in this organ impressed itself upon everyone who has had an opportunity to investigate the disease here. "Mal de cœur," as a popular name for uncinariasis, is not inappropriate.

PHYSICAL DIAGNOSIS.

Inspection.—The apex beat is pronounced in the light grades of the disease, due to overaction of the heart muscle. In the moderate

grades it is often found to be displaced downward and to the left. In the marked grades, a notable phenomenon is the great reduction of the force of the apex beat, which is replaced by a wavy, indefinite pulsation in the epigastrium. At times there is a tumultuous heaving of the whole precordium. Cyanosis is liable to be noticed in such cases, chiefly in the lips, and contributes to the muddy gray element in forming the color of so many anemics here. Two very severe cases of cyanosis due to heart dilatation were noticed in our special cases.

Palpation.—This corroborates the signs described above. A presystolic thrill is not infrequently noted in moderate, and especially in severe cases. In the Ponce series of 1902 one such case was noted; in the Utuado series of 1904 two were seen.

Percussion.—In the slight grades hypertrophy is generally not made out. In the moderate grades, hypertrophy, especially of the left ventricle, is the cause of the enlargement of the heart area which may reach to and even beyond the nipple line. In the severe grades a general increase is noted, often due to dilatation and sometimes to pericardial effusion.

Auscultation.—The point at which murmurs are best heard in this disease is the third left intercostal space. In light cases an impure first sound and snappy aortic valves may be the only sign present. In moderate cases hemic murmurs are almost always present and may take on a seemingly organic character. Indeed, they may become organic. Heart lesions are not rare in apparently healthy persons who give a clear history of having passed through a period of uncinariasis in early life. In dilatation the usual confusion of murmurs may be heard.

In the Ponce series of 1899 there were 8 with hypertrophy of the heart.

In the Ponce series of 1902 there were 7.

In the Utuado series of 1904 there were 18.

In the Rio Piedras series of 1906 there were 4.

In 111 cases there were 37, or 33 per cent.

Many of these cases had proceeded to dilatation, and in some this dilatation was extreme, with pulsation of jugulars and brachial veins, enlarged liver, etc. As a matter of fact, slight hypertrophy is exceedingly common in moderate cases at the clinic. We have only included in the 37 cases above cited such as were frankly hypertrophic.

The typical heart murmur of anemia, the "hemic murmur," is the most constant and is very frequent in all moderate cases. In the severe cases this murmur is often replaced by a series of murmurs embracing nearly all of the cardiac sounds to be distinguished in diseases of the heart, and this is natural when we come to consider the organic changes that supervene. Of these the most common modifications are a harsh, systolic, apical murmur, at times very loud indeed, and the diverse murmurs of cardiac dilatation. In the recapitulation of these murmurs in our cases we will understand by "usual hemic murmur" a sound of a blowing character, generally loud and obscuring the first sound, best heard at the third intercostal space on the left side.

In the Ponce series of 1899 there were 13 cases presenting cardiac murmurs—3 harsh, systolic, apical; 10 the usual hemic murmurs.

In the Ponce series of 1902 there were 16 cases with murmurs—5 harsh, systolic, apical; 11 usual hemic murmurs.

In the Utuado series of 1904, 52 presented cardiac murmurs—7 harsh, systolic, apical; 41 usual hemic murmurs; 1 purring aortic murmur after the second sound; 3 of extreme cardiac dilatation.

Thus of 99 cases, 81.9 per cent had cardiac murmurs; 18.5 per cent of whom had a harsh, systolic, apical murmur which seemed to be organic. That it was not organic, or that at least the valvular defect was remedied by nature, we were able to prove in some of these cases at a later date. We have not attempted to mention all cases giving evidence of cardiac dilatation, as these were so inextricably confused with the hemic murmurs as to prohibit an exactness which would be necessary for these statistics.

Lutz distinguishes four groups of cardiac phenomena which we can recommend as a most acceptable classification:

1. Phenomena in seemingly normal hearts, with acceleration of the beat.

2. Hypertrophy and dilatation, chiefly manifested in the left heart. There are increased area of dullness, exaggerated force of the beat, displacement of the apex, and cardiac murmurs. They may even be protrusion and pulsation of the precordium.

3. Signs of imperfect closure of the auriculo-ventricular valves of one or both sides; continuous murmur, even to obscurity of the second sound, or a systolic murmur over mitral valve, and accentuation of second pulmonary sound.

4. Group showing degeneration of cardiac parenchyma, with intermittent, irregular, and feeble pulse, and indistinct, at times almost imperceptible, heart murmur.

VESSELS.

At first the heart's overaction is but slightly noted, chiefly in the vessels of the neck. As the disease becomes more severe the tremendous pulsation in the supraclavicular spaces may be seen at some distance. Pulsation and bruit-de-diable are not infrequent. We have seen pulsation of the brachial vein and its ramifications, with every one marked by little knots, corresponding to the sites of valves. One of the most common errors in diagnosis may be aneurism of the vessels at the base of the neck and the aorta. Where harsh murmurs are transmitted to the arteries the pulsation and pain in the sternum are excessive, and where a thrill is perceptible it is really difficult to exclude aneurism on a simple examination of the circulatory system, and this may indeed become a complication.

Distension of superficial abdominal veins has been not infrequently seen.

In the Ponce series of 1899, 11 had noticeable throbbing of vessels of the neck; in the Ponce series of 1902 it was present in 15; in the Utuado series of 1904 it was present in 33. In the latter series 4 had a most tremendous heaving of these vessels. Of the 99 cases, therefore, 59, or 59.5 per cent, presented this symptom. These cases were accompanied, generally, by a well-marked bruit-de-diable.

In the Ponce series of 1899, 6 had visible undulation of the brachial veins; in the Ponce series of 1902, 5 presented this phenomenon.

As these were exaggerated cases of uncinarial anemia, they must be, of course, placed in the category of severe cases. For a good example of the general condition of such a patient see case 47 of the Utuado series of 1904 (Appendix).

A thrill at the root of the neck, systolic and very like aneurism, was found in 1 case of the Ponce series of 1902.

PRECORDIAL PAIN.

Excluding sternal pain, there is a cardiac pain, prolonged and diffuse. Some describe it as dull, others as sharp and burning. There is no irradiation wherein it differs from angina pectoris and aneurism. Lutz concludes that it is due to fatigue of the heart muscle, as it generally manifests itself after sudden, severe exertion. It was noted in 8 of the Ponce series of 1902; in 46 of the Utuado series of 1904, of whom 4 complained of severe pain; and in 9 of the Rio Piedras series of 1906—a total of 63, or 68.4 per cent.

PALPITATION.

This is one of the very first symptoms of the disease and one of the most prominent and constant. Light work may induce it, but later it may develop in repose and even as a result of passing emotions. It often becomes a very distressing symptom.

In the Ponce series of 1902 palpitation occurred in 16 cases; in the Utuado series of 1904 in 58 cases, in 6 of whom it was extreme; in 6 in the Rio Piedras series of 1906; in all, a total of 86 cases of 92, or 93.4 per cent.

DYSPNEA.

This is not so common as palpitation in the light cases, but it is certainly frequent and becomes universal in the later stages, where it may occcasion great suffering.

This symptom occurred in 50 of the Utuado series of 1904; it was slight in 8 and very severe in 6. In the Rio Piedras series of 1906 it was present in 11. In the Ponce series of 1899 and 1902 this symptom was not noted.

Thus of 73 cases 61 or 83.5 per cent were affected with dyspnea.

PERICARDIAL EFFUSION.

This is common in the later stages with edema and constitutes a further obstacle to heart action. Accurate data in all of our cases is not obtainable, but in some we demonstrated it.

PULSE.

In the first stages the pulse is strong and full, later it becomes dicrotic, then weak and compressible, until in the last stages it is rapid, thready, irregular, and intermittent. The artery, however, is almost never sclerotic and the pulse is soft. Increased frequency is a very common condition and is noted at the very inception of the disease without necessary relation to fever.

In the Ponce series of 1899 the pulse was weak and compressible in 8, weak and intermittent in 2, weak and thready in 2; a total of 12 cases with a weak pulse.

In the Ponce series of 1902 there were 6 cases in which the pulse was noted as weak, 2 with dicrotism, and 1 which was irregular and intermittent.

In the Utuado series of 1904 the pulse was weak and compressible in 29, weak in 7, weak, dicrotic, and compressible in 4, dicrotic and compressible in 4, and strong and full in 17; a total of 40 with a weak pulse and 8 with dicrotism.

In the Rio Piedras series of 1906 the pulse was weak and compressible in 9 and full and strong in 3, a total of 9 in whom a weak pulse was noted.

A weak pulse was noted therefore in 60.3 per cent and dicrotism in 9 per cent of the total 111 cases.

Only in the Utuado series of 1904 was the pulse rate systematically recorded under conditions proper for a true appreciation of the usual rapidity of a pulse; that is to say, when the patient was sitting down or in bed and free from mental excitement. The average rate in these cases was exactly 100.

DIZZINESS.

This is very annoying and very common, and is to be found in all grades of the disease, reaching its greatest intensity in the latter stages. Its severity is often all out of proportion to the anemia present.

It was not made a matter of record in the Ponce series of 1899.

In the Ponce series of 1902, 18 suffered from this symptom. In the Utuado series of 1904, 59 had it, 18 suffering very severely from it. In the Rio Piedras series of 1906, 11 complained of it. Thus a total of 88 or 95.6 per cent suffered from dizziness.

TINNITUS AURIUM.

This symptom is almost as frequent. Apart from mere ringing in the ears the patient complains bitterly at times of what he describes as "pooh-pooh" in the head, which seems closely related to cardiac and vascular murmurs, frequently preventing sleep by night and stupefying the patient by day.

Tinnitus aurium existed in 16 of the Ponce series of 1902; in the Utuado series of 1904 in 59, in 18 of whom it was very severe; and in the Rio Piedras series of 1906 in 11. Thus there was a total of 86, or 93.4 per cent, who suffered from this symptom.

SYNCOPE.

Many who state that they swoon really mean that the weakness becomes so extreme, with nausea, dizziness, and roaring in the ears, that they are obliged to sit down wherever they happen to be. Real fainting does, however, occur.

Syncope was reported by 10 of the Ponce series of 1902, and 29 of the Utuado series of 1904, a total of 39, or 48.7 per cent.

CEREBRAL EDEMA.

This fortunately not common accident may cut off a patient in a few hours when all indications point to a betterment. This apparently occurred in Leichtenstern's famous case with 72 per cent eosinophilia. The blood had reacted splendidly, but sudden cerebral symptoms supervened. Edema of the brain is not a very unusual occurrence, however, although it can not be called frequent. We lost several cases in this way, notably case 33, Utuado series of 1904 (appendix). It should be counted upon as one possible explanation of sudden death during treatment. We will mention later the tendency for thymol to cause, in severe cases, a sudden increase in serous effusion. Care, however, should be taken to eliminate cerebral edema before blaming thymol for a direct poisonous action. We feel sure that this error has been made by some authors.

RESPIRATORY SYSTEM.

There are no characteristic symptoms. Pain in the chest is due to other causes. Edema of the lungs may occur in severe cases. Hydrothorax is common in the last stages. A short dry "heart cough" is common.

THE URINE.

In April, 1907, we published (Drs. Ashford and King) in the Boston Medical and Surgical Journal (Vol. CLVI, No. 14) in an article entitled, "Observations on the campaign against uncinariasis in Porto Rico," a brief résumé of animal experimentation with regard to skin infection and study of the urine before and after the administration of the anthelmintics we had been employing. The paper was the result of the second year's campaign in Aibonito and in it we rectify our error of 1904 in considering the urine to be usually free from albumin.[1]

The study was made by all three members of the commission. Siccardi, about the same time, published his work in which he states that in all of his cases he was able to find more or less well-defined traces of albumin in the urine.

As the major part of this study treats of the influence upon the urine of the anthelmintics employed, we will reserve the full quotation for inclusion in the report of 1906–7, but for the present let it suffice to say that of the 23 cases of uncinariasis in the series of special cases for the study of the urine, 20, or 87 per cent, are seen to have had albumin in the urine before the administration of the anthelmintics. In 18 of these 20 cases, or 90 per cent, casts were also demonstrated. Generally the casts were few in number; in only 6 of the 18 were they at all abundant. The average hemoglobin percentage in those persons showing albumin before the administration

[1] In the first report of the Porto Rico Anemia Commission it is stated that albumin is rarely found, although note is made that the kidneys may be very pale and slightly fatty, sometimes being the seat of parenchymatous inflammation, sometimes of amyloid degeneration, but generally speaking, without marked involvement of these organs. We would like to considerably modify our former opinion. It was based on the examination of a series of cases but was not made, as was the blood, a matter of special study, inasmuch as Heller's nitric-acid test and the absence of clinical evidence gave us no clue to the real condition. It is significant that writers on uncinariasis make practically the same statement with exception, among a few others, of Siccardi.

of the anthelmintic was 46.1. Sixteen of the 20 cases showing albumin before taking the specific drugs had but a slight trace, 1 a trace, 3 a fairly abundant amount.

Of the 23 who expelled uncinariæ, in 1 case the worms were not counted. In the rest, 9 expelled less than 300, and of these 2 had no albumin in their urine before the administration of the anthelmintic; 5 had a slight trace; 1 a trace; 1 a considerable amount. Eight expelled between 300 and 1,000 uncinariæ, and of these 1 showed no albumin before treatment; 6 a slight trace; 1 a considerable amount. Three expelled between 1,000 and 2,000, and of these 2 showed a slight trace and 1 a trace of albumin before the drug. Those who expelled more than 2,000 uncinariæ (one 2,749, the other 4,397) gave only slight traces of albumin before treatment, demonstrable solely by boiling.[1]

The varieties of casts found is of interest:

Hyaline, few	4
Hyaline and granular, few	6
Hyaline, granular and fatty, few	1
Epithelial, few	1
Hyaline, many	2
Hyaline and granular, many	3
Hyaline, granular and fatty, many	1
	18

Urobilin was almost always present, fluorescence by the zinc chloride test being elicited, but it was often remarkably slight, even with a profound anemia and heavy infection.

Peptones in traces were found to be inconstant, but often demonstrable.

Indican in abundance was a very constant and persistent phenomenon.

Bile pigment was relatively rare.

The specific gravity tended to be low. Of 19 of the series of special cases for the study of the urine, the average specific gravity was 1.013.

Sugar was not present in any examination made by us.[1]

Of the Ponce series of 1902, 16 in which the specific gravity was taken gave an average of 1.009; in 15 of the 16 the reaction of the urine was acid; and in 3 there was much albumin with hyaline and epithelial casts.

Eighty-seven per cent seemed to us very high for albumin in the urine of the average case of uncinariasis. These special cases have the common defect that they reflect faithfully the picture in intense cases, but do not usually portray the average case. So we determined to take any number of cases in the daily clinic just as they happened to come, and in a series of 127 out-patients we found 34 who contained albumin in their urine, a percentage of 26.7. These examinations were made in persons who had never taken the anthelmintics, and from this it can be affirmed that about one-fourth of all cases of all grades have albumin in their urine. Six of the 34 had a heavy precipitate of albumin by the boiling test, and 5 had casts, generally hyaline and granular, with now and then a fatty or epithelial cast.

Siccardi confirms these investigations of 1905 by stating as follows:

Nei miei casi le orine, sempre acide, contengono tutte, in traccei piu o meno sensibili, l'albumina.[2]

He failed, however, to find casts in his four cases. He attributes the albuminuria, as do we, to a toxin.

[1] Ashford and King, Boston Med. and Surg. Journal, Vol. CLVI, No. 14.

[2] In my cases the urine, always acid, never failed to contain albumin in more or less appreciable traces.

THE BLOOD.

The blood gradually loses color and consistency until in severe cases it is pale, thin, and watery, resembling "beef washings." Instead of exuding in a globular drop it spreads out and runs down the lobe of the ear so that it is often difficult to secure one of sufficient size for examination.

Coagulation was observed to take place slowly, but it was not timed exactly; neither did we attempt to study reaction, specific gravity, volume of corpuscles, and volume of blood, owing to lack of time and instruments.

HEMOGLOBIN.

We used the v. Fleischl hemoglobinometer as a standard until 1905; thereafter the Dare, as the latter is, after sufficient practice, just as accurate and much more of a time saver.

Regarding the hemoglobin percentage as the best index to the grade of the anemia, it was estimated in a certain number of cases in each year's campaign up to 1907, when the variations to which it was subject were sufficiently plain to us, and it seemed unnecessary in view of far more practical work to continue our readings.

The following table will serve as a basis for a study of the changes in the hemoglobin in this disease:

	Number cases with 20 per cent Hb and less.	Average Hb percentage.	Number cases with from 21 to 30 per cent Hb.	Average Hb percentage.	Number cases with from 31 to 60 per cent Hb.	Average Hb percentage.	Number cases with 61 per cent and over.	Average Hb percentage.	Total number of cases.	Average Hb percentage.	Average gain in Hb on treatment.	Average days under treatment.	Percentage of total cases attaining 80 per cent Hb.
Ponce, 1899	10	16.6	8	25.2	.....	.....	.....	.....	18	20.4	.....	.....	.....
Ponce, 1902:													
First group	17	11.8	12	25.2	14	41.1	.....	.....	43	25.1	43.3	111	37
Second group	6	13.6	11	27.8	22	41.7	5	71.8	44	37.8	.....	.....	.....
Utuado, 1904	26	14.8	20	24.7	14	38.5	1	65.0	61	24.3	64.7	62	80
Albonito, 1905:													
"B. N." group	6	16.3	7	24.4	9	38.3	5	82.8	27	38.0	45.7	33	74
Thymol group	10	16,2	6	24.6	16	41.8	6	86.1	38	39.3	47.2	33	66
Urine group	3	15.3	1	27.0	3	38.0	2	87.5	9	40.2	31.6	24	55
Other groups	11	14.1	2	25.0	6	44.0	.....	.....	19	24.7	63.7	52	79
Rio Piedras, 1906:													
First group	7	15.8	3	27.0	2	46.5	.....	.....	12	23.7	17.0	36	.....
Second group	2	14.0	.....	.....	5	37.4	3	75.3	10	44.1	.....	.....	.....
Total	98	15.0	70	25.0	91	40.7	22	79.8	281	30.9	51.3	58	66

In addition to the above, the hemoglobin percentage was estimated in 579 cases at random in the clinic at Bayamon, representing all grades of the disease, the percentage ranging from 9 to 101. The average reading in these cases was 43.09 per cent.

A few remarks regarding the various groups of cases into which they are divided should be made that percentage variation be understood:

Ponce series of 1899.—Medium and benign cases were not studied in this series, therefore the average hemoglobin for the group is

low. These cases could not be followed up, owing to a change in station of Dr. Ashford shortly afterwards.

Ponce series of 1902.—This was really the first series in which treatment was regularly carried out in each case. Beyond a few general rules, the use of thymol in large doses for the expulsion of uncinariæ was neither explained nor very favorably commented upon in the works of reference at the command of Drs. Ashford and King. As a matter of fact, Thornhill's and Leichtenstern's terrible experiences with thymol were recited with such earnestness that we only dared to give the drug at rare intervals, and then with extraordinary precautions, especially as the class of cases we had under treatment were often extremely grave. The result was that the average gain in percentage of hemoglobin was much less than it should have been and the average days under treatment was very unnecessarily, though at that time justifiably, long drawn out. In the Ponce series of 1902 we divide our cases into the first group, in whom blood records and histories were fairly complete, and into a second group, in which only the Hb and differential counts were made.

Utuado series of 1904.—In this series a settled policy was adopted in the treatment of our cases, and 61 were selected, generally from among the sickest of our patients, for weekly examinations just previous to each dosage with thymol. In this series the fruit of our experience in Ponce in 1902 permitted us to give the drug boldly, allowing, of course, for such modifications as only a physician is authorized to make in the presence of numerous and serious complications of the disease, such as the administration of cardiac stimulants, etc. Thus our results were infinitely better, and the time lost in hospital was much less.

In these three series the blood was made the chief object of our research, and to this end very anemic patients were usually selected for treatment in hospital. In the succeeding series, however, the observation of the blood became only a side issue.

The Aibonito series of 1905.—Two chief objects now claimed our attention; one, the counting of all uncinariæ expelled after each dose of each of the principal anthelmintics, and the other, a study of the urine before and after the administration of those drugs. Therefore in these cases the anemia is not so severe, as a rule, nor was effort made to retain the patient in hospital until a normal hemoglobin was attained. Thus the average hemoglobin is greater, the gain under treatment is less, and the number of days in hospital very much less than in preceding series. The "urine" group is a set of cases in which the urine was being studied; the "thymol" group a set in which the uncinariæ expelled by that drug were counted; and the "B. N." group is one in which betanaphthol was the anthelmintic.

The Rio Piedras series of 1906.—While the entire commission took part in the 1904 and 1905 series, only Dr. Gutierrez studied the Rio Piedras series. In this series blood examinations, although made for completeness, were not the chief feature of investigation, but rather the effect of the recently recommended eucalyptol treatment. When the latter object was accomplished, the patients, if they had not already left the hospital because of the severity of this so highly

recommended anthelmintic, were discharged before their hemoglobin had touched the normal point.

NOTABLE CASES IN THE VARIOUS SERIES.

In the 1902 Ponce series a hemoglobin below 10 per cent on admission was seen in three cases; one with 7, one with 8, and one with 9 per cent.

In the 1904 Utuado series three such cases were seen, all with 9 per cent hemoglobin.

In the 1905 Aibonito cases, one case presented 8 per cent, and one, the lowest we have ever seen, had but 4 per cent hemoglobin.

In the Rio Piedras series, two had but 8 per cent hemoglobin.

The average hemoglobin of our hospital cases herein detailed, over 90 per cent of which were of a moderate, intense, or very intense grade, was 30.9 per cent. The average of our 579 Bayamon outpatient cases was 43.09 per cent hemoglobin. These two percentages may be accepted as fair basis on which to calculate the average hemoglobin of the enormous mass of anemics in the years which initiated our work, 1904 and 1905.

It is to be here most strongly emphasized that in the percentage of hemoglobin and the relative number of eosinophiles we have, as far as the blood is concerned, two keys to the actual condition of the patient. The use of the hemoglobinometer gives us practically all the information necessary in the examination of the blood, save that obtainable from a differential count. We have long since come to the conclusion that the counting of the red blood cells, while interesting and scientific, is of little practical importance in the clinical examination of the blood in this disease, as the deleterious effect of the poison is most keenly felt by the hemoglobin.

The hemoglobin falls before the red-cell count and may even reach 30 per cent before much change is noted in the reds. (See cases 60, 64, and 71, first group, Ponce series, 1902, appendix.) This is one of the reasons why we can not think with Boycott and Haldane that a low hemoglobin is practically all a matter of hydremia. While we have had some cases with a color index exceeding 1, the average of a large number was 0.5, and thus uncinariasis can not ordinarily be confused with pernicious anemia.

Under treatment, the hemoglobin is usually outstripped by the red corpuscles especially if the former rises slowly. In some cases they move parallel. The influence of a few parasites over the hemoglobin, after the majority have been expelled, is widely different in different persons. In some it will rise but little until all worms are expelled; even a few, not sufficient to show ova in the stools except on repeated examinations, may keep it down. We have often observed a rapid rise after a judiciously timed dose of thymol under these circumstances. On the other hand, of course, the normal is often attained while the fecal specimen shows ova.

THE RISE IN HEMOGLOBIN UNDER TREATMENT.

It is well-nigh impossible to discuss the changes found in the hemoglobin in uncinariasis without referring to its behavior under the

specific drugs employed for its cure. The following table will serve as a basis for our remarks upon this subject:

URINE CASES.

Drug.	Hemoglobin on admission.	Hemoglobin on discharge.	Days under treatment.	Number of uncinaria expelled.
	Per cent.	*Per cent.*		
Beta-naphthol	35	96	14	453
Do	110	120	22	10
Do	27	50	49	908
Do	44	87	28	268
Do	65	58	28	28
Do	18	17	8	2,749
Do	13	95	36	246
Thymol	35	90	22	724
Do	15	34	15	884
Average	40.2	71.8	24.6	696

BETA-NAPHTHOL CASES.

Beta-naphthol	18	45	36	1,316
Do	21	64	44	1,122
Do	35	82	30	333
Do	34	86	38	864
Do	53	89	37	406
Do	35	96	16	497
Do	65	88	18	247
Do	35	93	24	654
Do	81	94	20	680
Do	29	99	46	1,727
Do	20	98	39	1,778
Do	18	98	36	650
Do	18	58	46	1,108
Do	33	44	10	235
Do	8	85	60	2,234
Do	[1] 58	105	41	1,566
Do	25	87	28	73
Do	[1] 65	60	21	542
Do	57	94	54	1,387
Do	24	90	33	2,724
Do	23	98	41	995
Do	37	95	34	352
Do	118	120	23	118
Do	22	85	51	946
Do	16	50	23	152
Do	44	105	49	1,195
Do	35	48	38	932
Do	27	56	21	725
Do	97	113	22	159
Average	38	83.6	33.1	886

THYMOL CASES.

Thymol	40	94	54	776
Do	12	79	47	1,122
Do	22	92	44	327
Do	14	65	49	1,979
Do	58	94	23	1,367
Do	16	95	51	1,361
Do	25	44	36	4,395
Do	32	81	48	3,493
Do	18	69	54	1,167
Do	120	.....	.....	574
Do	18	.....	.....	551
Do	20	120	46	2,073
Do	35	80	21	959
Do	15	120	36	1,021

[1] These two cases did not have their hemoglobin percentage taken on admission and hence are excluded in calculating the averages.

THYMOL CASES—Continued.

Drug.	Hemoglobin on admission.	Hemoglobin on discharge.	Days under treatment.	Number of uncinariæ. expelled.
	Per cent.	*Per cent.*		
Thymol	35	100	32	1,007
Do	28	120	32	2,015
Do	35	82	32	1.871
Do	20	110	31	465
Do	10	120	43	544
Do	27	99	46	490
Do	59	93	22	908
Do	40	100	28	881
Do	39	95	24	1,352
Do	25	70	49	1,446
Do	37	94	38	424
Do	64	61	29	847
Do	39	68	15	1,148
Do	89	109	12	236
Do	88	120	15	386
Do	73	112	24	326
Do	40	50	17	716
Do	19	47	44	623
Do	83	91	10	249
Do	50	92	22	1,160
Do	47	94	53	1,110
Do	40	42	53	96
Do	44	76	22	2,316
Do	21	39	16	1,348
Average	39.3	86.5	33.8	870

If there is one thing more than another which attracts the attention it is that the number of parasites harbored and the hemoglobin do not seem to follow any hard and fast rule in their relation, the one with the other. To further emphasize this point, which is an important one, let us refer also to the following table, in which the worm-count cases are divided, according to the percentage of their hemoglobin, into four classes which may be considered as representing the very intense, intense, medium, and benign grades of the anemia. Here one would expect to find, if intestinal hemorrhage were the chief cause, a greater consonance between the number of worms expelled and the intensity of the anemia, but compare cases having almost identical initial hemoglobin percentage and see the widely differing number of uncinariæ they expelled. If it were at all doubtful that all worms were not expelled in the series or that all which were expelled were not counted, the position taken would be a weak one, but knowing as we do that these counts, which we alone made, are correct, and that the patients' evacuations were carefully checked by ourselves and perfectly trustworthy assistants the table has an unusual significance. We do not pretend to say what poisonous product of uncinariæ does this, but we can not understand how uncinarial anemia can be produced principally by the direct loss of blood, judging from our own experience elsewhere described, even conceding the additional fact that there is a substance secreted at the site of the "bite" which prevents the coagulation of blood and permits continued capillary hemorrhage and that frequent change in the feeding ground of the worms multiplies these wounds. It is begging the question to say that at times blood is found in the feces, occult or formed, when not only ourselves but others (notably Siccardi and Spargella) have found this to be the exception rather than the rule.

We have not sought occult blood for reasons given, although we now wish that we had done so in view of the fact that certain Italian authors have often failed to find it, but the color of feces means something as does this tabular data which we do not offer as proof that the anemia is not the result of the direct loss of blood from hemorrhage but only as a piece of strong circumstantial evidence that there may be another factor in the pathogenesis of this anemia.

Number of uncinariæ expelled in persons with very intense, intense, medium, and light grades of anemia.

AIBONITO SERIES; BETANAPHTHOL AND THYMOL GROUPS.

	Very intense.		Intense.		Medium.		Light.	
	Hemoglobin.	Number of uncinariæ.	Hemoglobin.	Number of uncinariæ.	Hemoglobin.	Number of uncinariæ.	Hemoglobin.	Number of uncinariæ.
	Per cent.		*Per cent.*		*Per cent.*		*Per cent.*	
Thymol	12	1,122	22	327	40	776	120	574
Do	14	1,979	25	4,397	58	1,367	64	847
Do	16	1,361	28	2,015	32	3,493	89	236
Do	18	1,167	27	490	35	959	88	336
Do	18	551	25	1,446	35	1,007	73	326
Do	20	2,073	21	1,348	35	1,871	83	249
Do	15	1,021			59	908		
Do	20	465			40	881		
Do	10	544			39	1,352		
Do	19	623			37	424		
Do					39	1,148		
Do					40	716		
Do					50	1,160		
Do					47	1,110		
Do					40	96		
Do					44	2,316		
Average	16.3	1,090	24.6	1,670	41.8	1,224	86.1	428
Betanaphthol	18	1,316	21	1,122	35	333	65	247
Do	20	1,778	29	1,727	34	864	81	680
Do	18	650	25	73	53	406	65	542
Do	18	1,108	24	2,724	35	497	118	118
Do	8	2,234	23	995	35	654	97	150
Do	16	152	22	946	33	235		
Do			27	725	58	1,566		
Do					57	1,387		
Do					37	352		
Do					44	1,195		
Do					35	932		
Average	16.3	1,206	24.4	1,187	41.4	765	85.2	349

Incomplete worm-count cases.

Drug.	Hemoglobin on admission.	Hemoglobin on discharge.	Days under treatment.	Number of uncinariae expelled.
	Per cent.	*Per cent.*		
Betanaphthol	12	55	64	556
Do	20	40	38	543
Thymol	52			178
Do	22	47	47	1,446
Betanaphthol	9	37	50	1,020
Do	65			639
Average	30	44.7	49.7	730

Rio Piedras cases.

FIRST GROUP.

Drug.	Hemoglobin on admission.	Hemoglobin on discharge.	Days under treatment.	Number of uncinariae expelled.
	Per cent.	*Per cent.*		
Eucalyptol	18	.....	.....	447
Thymol	8	50	96	950
Do	21	26	22	874
Eucalyptol	19	.....	.....	276
Do	30	.....	.....	271
Do	20	48	30	1,492
Do	30	.....	.....	12
Thymol	8	14	25	1,644
Do	19	23	10	304
Average	19.2	32.2	36.6	696

SECOND GROUP.

Eucalyptol	76	.....	.....	561
Do	33	.....	.....	21
Do	14	.....	.....	220
Do	70	.....	.....	45
Do	46	.....	.....	458
Do	45	.....	.....	276
Do	14	.....	.....	18
Do	31	.....	.....	420
Average	41.1	.....	.....	252

These cases were not followed sufficiently long to ascertain whether all uncinariae were expelled or not as the patients ran away from hospital or felt so much improved as to be able to return to work and could not be persuaded to stay.

With regard to the average of the out-patient clinic and the changes in the hemoglobin in such patients, we will refer again to the 579 Bayamon cases. In that series subsequent hemoglobin readings were made on 423 with the following results: Three hundred and seventy-one gained from 1 to 71 per cent, average gain 21.34; 45 lost from 1 to 16 per cent, average loss, 5.04; 7 neither gained nor lost. It must be understood that they were under treatment and observation varying lengths of time and few over six weeks.

The rise in hemoglobin is not a regular ascent, but subject to marked variations in the same individual. It may fall just after the beginning of treatment or fall after rising considerably, then continue to rise. In the above 423 cases at some time during their course, 45 rose after falling more than 3 and 38 fell more than 3 after having risen. Had those of the latter group and the 45 which lost been taken later, they might have shown a net increase.

This irregular course was also manifested by the special cases in the Utuado series of 1904. In 42 of them the hemoglobin reached 85 per cent or above, averaging 100.38 per cent. A weekly rise of 20 to 30 per cent was not uncommon and in case 58 of that series it rose 42 per cent. The patients looked and felt correspondingly improved. We believe that two factors may be here engaged.

(1) That the blood regenerating organs, working overtime to offset the deleterious effect of the parasites and being relieved of much opposition by the removal of a large number, produce a rapid actual increase.

(2) While not agreeing with Boycott and Haldane that it is all a simple hydremia, yet it would seem from their experiments that there is more or less increase in the volume of the blood, and that during progress of cure this condition is more or less rapidly remedied, producing a relative increase.

A very noticeable peculiarity of these low hemoglobin percentages is that persons with as low as 16 to 20 per cent can and do keep at their accustomed labor. It is painful to witness but it is a fact. Boycott and Haldane note this also, but attribute it to what they conceive to be a hydremia. They state that, were the blood reduced in fact as it is apparently demonstrated by the hemoglobin percentage, work would be suspended long before such low percentages were reached. These observers give a series of experiments to demonstrate that the total oxygen capacity of the blood was only slightly, if at all, decreased. They were obliged to use almost as large a quantity of CO to saturate the hemoglobin in anemics from uncinariasis as in a normal person. In other words, the total oxygen capacity was reduced by only 11 per cent and the volume of the blood was increased by 94 per cent. They deduced that in place of anemia there is really a hydremic plethora and that hemorrhage can not be the cause of the blood condition, as by hemorrhage there would be a reduction in hemoglobin and the CO necessary to saturate it would be much less than is actually the fact. They class uncinarial anemia in this regard with chlorosis.

RED CELLS.

The following table shows the average red-cell count in each of the series in which the red cells were counted. They are grouped according to the percentage of hemoglobin into very intense, intense, moderate, and light grades of anemia.

Average red-cell count.

	Series, Ponce, 1899.	Series, Ponce, 1902.	Series, Utuado, 1904.	Series, Rio Piedras, 1906.
Number cases with 20 per cent Hb. and less	11	17	26	9
Average red cells per c. mm	1,593,947	1,632,441	1,716,627	2,372,044
Number cases with from 21 to 30 per cent Hb	7	12	20	3
Average red cells per c. mm	2,062,537	2,832,755	2,608,664	3,148,266
Number cases with from 31 to 60 per cent Hb	.....	14	14	7
Average red cells per c. mm	.....	3,427,048	3,259,600	4,382,880
Number cases with more than 60 per cent Hb	.....	.....	1	3
Average red cells	.....	.....	4,352,000	5,080,933
Total number cases	18	43	61	22
Average Hb. per cent these cases	20.4	25.1	24.3	33
Average red-cell count, all cases	1,776,188	2,551,703	2,406,427	3,487,098
Average color index	0.57	0.49	0.50	0.47

A much more profitable way of studying the influence of the disease upon the red-cell count is seen in the following table. Here only the 61 Utuado cases are considered, as they are the only ones with a consistent weekly blood record. The count on admission with corresponding hemoglobinometric reading is compared with the same data on the occasion of the first count not falling below the normal of 5,000,000 per c. mm. and with the highest red-cell count noted in the course of the disease during its treatment. In addition, the number of days of treatment required to bring the red cells to normal is shown.

Series, Utuado, 1904.

Case.	On admission.		First count not showing a reduction in red cells, with hemoglobin of that date.			Highest red cell count noted, with hemoglobin on that date.	
	Hemoglobin.	Red cells.	Hemoglobin.	Red cells.	Days.	Hemoglobin.	Red cells.
1	33	2,968,000	67	5,261,600	51	83	7,635,200
2	38	3,968,800	37	5,400,000	15	66	6,632,000
3	25	2,640,000	103	5,048,800	71	103	5,048,800
4	28	2,656,000	41	5,066,400	29	82	6,720,000
5	45	4,432,000	70	5,506,400	22	90	5,835,200
6	22	2,288,000	66	5,020,100	65	66	5,020,100
7	10	2,266,640	25	5,000,000	22	76	6,755,200
8	34	2,292,800	47	5,048,800	38	56	6,724,000
9	20	2,600,000	58	5,372,800	50	58	5,372,800
10	20	3,195,520	41	5,901,600	39	104	6,724,000
11	32	2,656,000	60	5,600,000	88	80	6,400,000
12	27	2,306,640	.....	.....	.....	.....	.....
13	14	1,226,400	95	5,092,800	87	109	5,190,400
14	16	1,551,200	59	5,238,400	43	90	6,688,000
15	11	1,608,800	50	5,382,160	36	87	7,400,000
16	20	1,656,000	90	5,320,000	91	90	5,320,000
17	9	1,062,160	.....	.....	.....	.....	.....
18	16	1,584,000	80	5,492,800	92	82	5,795,200
19	28	3,480,000	54	5,786,400	29	103	7,088,000
20	22	2,976,000	70	5,284,000	26	70	5,284,000
21	13	1,240,000	102	5,040,000	70	102	5,040,000
22	12	984,000	75	5,064,000	36	71	5,624,000
23	14	2,372,800	60	6,244,000	36	60	6,244,000
24	26	2,195,200	75	5,068,000	90	90	6,440,000
25	22	1,946,640	51	5,017,600	29	100	5,184,000
26	52	2,420,000	61	5,280,000	22	85	5,536,000
27	27	2,288,000	62	5,224,000	29	70	6,390,400
28	11	1,616,000	54	5,124,000	22	73	6,430,400
29	24	2,492,800	.....	.....	.....	.....	.....
30	24	2,581,600	103	6,106,600	35	103	6,106,600
31	29	2,216,000	83	5,024,000	64	83	5,024,000
32	19	1,897,600	86	5,184,000	76	86	5,184,000
33	9	754,400	.....	.....	.....	.....	.....
34	24	3,137,600	46	5,075,200	43	60	5,760,000
35	23	2,572,800	.....	.....	.....	.....	.....
36	12	1,160,000	86	5,096,000	63	101	5,136,000
37	15	2,468,000	82	5,044,000	49	87	6,000,000
38	10	880,000	85	5,354,400	70	85	5,354,400
39	13	1,820,800	66	5,709,600	57	92	6,088,800
40	21	2,264,000	69	5,312,000	58	84	5,944,000
41	9	1,624,000	89	5,016,000	50	101	5,120,000
42	31	2,844,000	.....	.....	.....	.....	.....
43	20	1,360,000	.....	.....	.....	.....	.....
44	40	3,981,600	60	5,684,000	22	100	7,724,000
45	16	1,776,000	.....	.....	.....	.....	.....
46	35	2,732,800	85	6,856,000	29	85	6,856,000
47	32	2,195,200	93	5,000,000	29	102	6,261,600
48	26	2,517,600	45	5,492,800	15	102	7,008,800
49	26	2,284,000	.....	.....	.....	.....	.....
50	27	2,080,000	102	5,832,800	36	102	5,832,800
51	20	2,160,000	80	5,261,600	43	83	5,524,000
52	25	3,741,600	76	5,386,400	29	76	5,386,400
53	25	4,128,000	85	5,337,600	22	109	6,097,600
54	40	4,336,000	104	5,506,000	36	104	5,506,000
55	39	2,560,000	63	5,248,000	29	100	5,368,800
56	33	3,221,600	97	6,061,600	43	97	6,061,600
57	56	5,025,600	56	5,025,600	54	83	6,200,000
58	65	4,352,000	107	5,346,400	8	107	5,346,400
59	18	1,212,800	.....	.....	.....	.....	.....
60	19	2,360,000	.....	.....	.....	.....	.....
61	22	1,576,000	.....	.....	.....	.....	.....
Average	24	2,406,422	57	5,364,597	44.6	87.3	5,988,030

Taking all grades of the disease as encountered in Porto Rico, the average on admission is too low, as our experience has been that the reds are relatively less decreased in the milder cases.

Under treatment, the production of red corpuscles proceeds rapidly, reaching and exceeding normal some time before the hemoglobin. While for 80 per cent of these cases an average of 62 days were required to bring the hemoglobin to 80 per cent or over, the remaining 20 per cent of the cases not even attaining that percentage, only 44.6

days were needed for the red cells to reach and to pass 5,000,000 per cmm. An interesting feature of this table is the tendency under treatment for the red cells to rise to a surprising number in excess of 5,000,000 per cmm., and this often while the hemoglobin lags well behind below normal. This rise is only seen a brief time, as a rule, as a fall to normal usually occurs very rapidly. The rise is probably due to the microcytosis which occurs as a result of specific treatment. In this connection we wish to state that blood platelets increased in number, at times enormously, as the condition of the blood improved. No counts of these cells were made, but unusually high numbers are to be found in our clinical histories of these cases.

As the anemia progresses, the cells become polychromatophilic and show poikylocytosis. We have never seen these conditions absent in severe cases. Macrocytes and microcytes are constantly seen in such cases, and while, as a rule, the latter are more numerous, the former often predominate, especially in severe cases before treatment, and, with oval forms and megaloblasts, present a picture very suggestive of pernicious anemia if only the stained smear be depended upon for diagnosis. The assertion has been made that this secondary anemia may become pernicious, but while uncinarial anemia is often pernicious in the sense that it is frequently fatal, and sometimes even when all parasites are expelled, owing to a more or less complete exhaustion of the hemopoetic organs, this is not pernicious anemia. We do not believe that true pernicious anemia can be the result of uncinarial anemia; were this so, the severe cases we relate in this work would have, at least some of them, failed to respond to specific treatment.

One who makes a diagnosis of pernicious anemia in a case which fails to respond in several months to specific treatment that has relieved the patient of all uncinariæ should see that same patient after 9 months or a year.

Normoblasts are fairly common and in many instances increase, while megaloblasts show a tendency to diminish under treatment. There is little doubt in our minds that at irregular intervals in practically all cases there are showers of normoblasts. The megaloblasts are seldom very large. Macrocytosis also gives way to microcytosis as improvement is noted. The extremes in size of both classes were often seen in bad cases.

In 51 of the 61 Utuado cases our notes on the blood refer with great care to the degree of poikilocytosis, polychromasia, macrocytosis, microcytosis, and to the number of normoblasts, megaloblasts, myelocytes, and stimulation cells. Omitting the last two, which will be considered under the caption of leucocytes, the following summary will establish the frequency of departures from the normal in this regard for grades of the anemia which these cases represent:

Summary of notes on changes in red blood cells in 51 cases of the Utuado series.

Change.	Poikylocytosis.	Polychromasia.	Macrocytes.	Microcytes.
None	1	5	3	4
Slight	5	6	.....	.....
Few	.....	.....	5	4
Moderate	16	14	21	20
Marked	21	20	.....	.....
Many	.....	.....	22	23
Extreme	8	6	.....	.....

In 32 cases of the 51 the predominance of macrocytes over microcytes and vice versa was distinctly expressed. The microcytes predominated in 19, the macrocytes in 13.

Normoblasts were found in 30 of the 51 cases; the average number per cmm was 67.9. It should be explained in this connection that in each case where normoblasts were noted the highest number appearing throughout the case was taken in calculating this average. The same should be applied to our remarks on the megaloblasts. High normoblast counts were 173.6; 102.4; 268.8; 153.6; 217.6 per cmm.

Megaloblasts were found in 11 of 51 cases with an average of 54.6 per cmm per case. The megaloblasts exceeded the normoblasts in number in four of these cases.

The 10 cases of the Utuado series which are not included had the simple remark, "usual blood changes," so that, although they could not be included in the statistical data, they were all similar to the above.

Cases in this series of especial interest are the following:

Unusually low red cell count.—Case 22 (984,000 per cmm); case 33 (754,400 per cmm); case 38 (880,000); case 59 (964,000 per cmm).

Stained smear resembles pernicious anemia.—Cases 12, 50, and 59 are perfect pictures of blood of pernicious anemia.

Case 15 had one enormous macrocyte, 20 microns in diameter, among many others not quite so large. In this case macrocytosis was found. Later the picture changed to that found in chlorosis with a predominance of smaller red blood cells.

Case 17; one-third of the red cells were oval and abnormally large.

Case 18; macrocytes very large.

Irregularity in size of reds.—Case 10 had hardly a single normal sized cell.

Cases 34 and 52; changed from macrocytosis to microcytosis under treatment.

Cases 38 and 48; macrocytes and microcytes about equal in number on first examination; later, in course of treatment, microcytosis made itself evident.

Especially interesting cases in the Ponce series are:

Series of 1899.—Case 2 had a color index of 1.43 and the lowest count of red cells ever made by us, with the exception of one recount in case 10, same series. This case could have been well confounded with pernicious anemia as there were many macrocytes, poikylocytosis, polychromasia, and 46 megaloblasts per cmm. It is true that there were at the same time 144 normoblasts per cmm, but variation in this regard is not so unusual in essential anemia.

Series of 1902, first group.—Case 13 gave a red cell count of 960,640 per cmm; case 15 gave 904,370.

THE LEUCOCYTES.

We are unable to demonstrate a characteristic leucocytosis in uncinariasis. In the majority of cases the number of these cells lies somewhere between 5,000 and 10,000 per cmm, and often in chronic cases of long standing there is leucopenia. There is generally some other reason for leucocytosis, save in certain cases toward the end of their convalescence. It may be seen where mazamorra has

produced extensive eruption, or an increased volume of the blood may influence the count as in the case of red cells. The differential counts of leucocytes were made in the usual manner.

In 1899 the Ehrlich triacid stain was used; in 1902 and 1904 the Jenner stain was employed as a standard although Wright's, Leischman's and Goldhorn's were frequently used in especially interesting cases; in 1906 the Teideman stain was the standard. Of the stains we have used, the Jenner was found to be the most stable in this country where the light is strong and the humidity great, and it gave most excellent results as prepared by ourselves. The more modern stains are better for fine nuclear changes and for this purpose they were used, but they last only an incredibly short time in Porto Rico and we were obliged to have frequent supplies forwarded us from the United States to replace those already deteriorating.

Only 250 leucocytes were counted for a differential, but it is believed that this number gives an exceedingly close estimate of the actual percentage.

In marked cases, there is a decided degeneration of leucocytes. This was most marked in eosinophiles, but very common in polymorphonuclear neutrophiles and in large lymphocytes. Pale, shredded cells were found; nuclei without protoplasm and others with only a few granules to distinguish their neutrophilic character; vacuolation of nuclei; fragmentation of nuclei, etc. Not only this, but frequent instances of mitosis (or apparent mitosis) in both eosinophiles and polymorphonuclears were noted. Neutrophiles were sometimes undersized and almost bereft of granules or oversized with large granules.

EOSINOPHILES.

The chief interest centered around the eosinophiles in all of these differential counts. It will be profitable to quote our remarks in the report made of our 100 cases in Ponce in 1902:

Before drawing conclusions, let us classify, in so far as possible, the cases in which the differential counts were made:

1. Cases showing eosinophile count of less than 15 per cent, but more than 10 per cent. These may be subdivided into:

(a) Those with but one count on admission and before treatment, viz, cases 1, 14, 20, 32, 33, 74, 81, 88, 93, 95.

(b) Those with two counts, one before treatment and the other after treatment had expelled a great number of uncinariæ, showing a rise in the second eosinophile count over that recorded on admission, viz, cases 2, 71, 86.

(c) Same as b, but that a fall or no change is noted in the second count, viz, cases 65, 70, 89.

2. Cases showing an eosinophile count of less than 10 per cent:

(a) Those with but one count on admission and before treatment, viz, cases 5, 24, 28, 36, 49, 62, 64, 75, 76, 87, 91, 92.

(b) Those with two counts, one before treatment and the other after treatment had expelled a large number of uncinariæ, showing a rise in the second eosinophile count over that recorded on admission, viz, cases 3, 13, 68, 84, 85.

(c) Same as b, but that a fall in the second count is seen, viz, case 69.

3. Cases showing a high eosinophilia (above 15 per cent) before treatment, viz, cases 22, 23, 60, 61, 66, 67, 90, 98.

4. Cases showing a high eosinophilia (above 15 per cent) some time after beginning treatment, but without a count before treatment, viz, cases 4, 15, 19, 40, 41, 42, 43, 57, 77.

5. Cases showing low eosinophilia (below 15 per cent) under the same conditions, viz, cases 8, 12, 44, 78, 82, 83.

6. Unclassified cases, viz, cases 9, 17, 18, 29.

From this data we may, with caution, make the following deductions:

(A) Uncinariasis is a disease marked at some period of its course at least by eosinophilia. In all cases a proper interval, generally a week, was left after administration of thymol to insure its thorough elimination that the differential count might not be influenced by the drug, other well-known causes of eosinophilia being absent.

(B) In those who have suffered but a short time from the disease, or whose blood regeneration is still active, a high eosinophilia is to be expected. Such cases are 23, 61, 66, 67, 90. Case 22, with 16.8 per cent, and case 98, with 17.3 per cent, are exceptions to this statement, yet they can hardly be said to negative the rule, as they are but little above the arbitrary limit of 15 per cent.

(C) In chronic uncinariasis or in those who have been for a long time subject to profound anemia, the eosinophile count is more apt to be low than high. An exhausted or malnourished condition of the bone marrow may explain this condition. Such cases are those cited under headings 1 and 2, and possibly others.

Apparent exceptions to this rule are cases 5, 18, 62, and 74, but the statements of patients are often inexact concerning the beginning of the disease; in fact such data are most difficult to determine on account of the insidious onset.

(D) After treatment in chronic cases and in those in the later stages of the disease, a rise in eosinophiles may be expected and is of good prognostic import. It may be due to a more active regeneration in the bone marrow. Cases illustrating this are 2, 3, 13, 68, 71, 84, 86, and probably others in which the data are lacking which would enable us to include them.

(*e*) When, however, there is a fall of eosinophiles, accompanied by lack of improvement in physical signs, death may often be the result. Care must be taken to distinguish this from the final fall in eosinophiles which marks the establishment of the blood equilibrium and the return to health.

In general, also, a slow rise of eosinophiles marks a long convalescence, as is frequently seen in the old, whose recuperative powers are limited. Illustrative cases are 12, 44, 69, 78, 82, and 89. Cases 12, 69, and 82 are improving very slowly; case 44 is almost sure to terminate fatally. In case 78 the patient nearly died during a period corresponding to an eosinophile count of 1 per cent; case 89 remains unimproved.

Cases 22, 24, 49, and 76 all terminated fatally, and, with the exception of case 22, all the patients had a very low eosinophile count.

While this was a careful study, it had the disadvantage of having to depend on irregular blood data. The weekly differential counts of the 61 Utuado series do away with this source of error and give us ideal data upon which to base a corroboration of the conclusions of 1902.

Of these cases, 34 had a rise in eosinophiles under treatment and upon their recovery were discharged with a higher eosinophile percentage than that with which they were admitted to the hospital.

Seventeen showed a rise under treatment, with a subsequent fall to a percentage below that which they possessed when admitted. They were generally cases whose fall in eosinophilia corresponded to the final fall to the normal blood count on recovery.

This gives a percentage of 87.9 of 58 cases who did not die in whom a rise in eosinophile percentage occurred under treatment. In general these rises were remarkably high.

Seven cases showed a fall in eosinophiles under treatment; 2 of these were cases of concomitant tuberculosis pulmonalis and 1 was a light case of uncinariasis.

Of the 3 that died, cases 17, 33, and 42, none had eosinophilia on admission and in 2 the eosinophile percentage they had on admission went down under treatment. Case 33 is an example of a favorable blood reaction cut short by death from an accident, viz, a sudden and immediately fatal edema of the brain.

The following cases never had an eosinophile percentage reaching 10 during the entire period of their stay in hospital: Cases 12, 13, 17, 18, 23, 25, 35, 38, 42, 46, 53, 58, and 59. Of these cases, 12 and 23 were tuberculous, 17 and 42 died, 18 was extremely stubborn in his recovery and was expected to die on several occasions, and case 58 was a slight case which can not be considered in the light of what has been said.

Therefore we feel ourselves justified in reiterating our conclusions of 1902 succinctly as follows:

1. Very severe chronic cases with poor resisting power and exhausted blood-making organs have little or no eosinophilia.

2. A rise in eosinophiles is generally found in cases which progress favorably and should influence the prognosis.

3. If very severe cases, presenting little or no eosinophilia, fall in their eosinophile percentage without improving in their general condition the prognosis for such a case is less favorable.

In general good resistance to the poison of uncinaria is expressed by eosinophilia. The cases found in the Utuado series of 1904, being nearly all severe, gave an average of 10.8 per cent eosinophiles before treatment was begun and an ultimate percentage, after all treatment was concluded, of 13.7.

But the most interesting feature of these differential counts is revealed in the average of the highest eosinophile percentages during the course of the treatment; this was 21.24 per cent.

As 42 of the 61 Utuado cases were completely cured at the time of the last count, and 15 were nearly so, it is clearly seen that the number of uncinariæ has nothing to do with eosinophilia directly. As to the oft-cited remark that eosinophilia and Charcot-Leyden crystals increase and fall together, there are cases which fail to show such relation.

The eosinophiles behave in the most extraordinary way in the course of cure. There seems to be a general rise to a certain percentage, varying according to the individual, after which a fall to normal takes place. This fall to normal may occur before the patient reaches a normal hemoglobin percentage or may be delayed until some time after cure. In this course of rise and fall, great undulations may take place in the curve, which as yet seem to be difficult to explain.

The eosinophiles which we have seen in this study of the leucocytes are almost always larger than normal. Sometimes they are very large and tend to degeneration, apart from their evident fragility seen in preparation. The granules are also very large. Myelocytes are more frequently eosinophilic than neutrophilic.

The following table gives a detailed account of the number of leucocytes per cmm, the corresponding hemoglobin and the eosinophile percentage before treatment, the same data on the occasion of the highest eosinophile percentage registered during the course of the case and after all treatment was concluded.

Case.	On admission.			On occasion of highest eosinophile count.			On discharge.		
	Hemoglobin.	Leucocytes per cmm.	Eosinophile.	Hemoglobin.	Leucocytes.	Eosinophile.	Hemoglobin.	Leucocytes per cmm.	Eosinophile.
1	33	13,200	16.8	36	5,000	22.4	101	7,800	8.8
2	38	6,000	13.6	50	18,400	23.5	100	22,600	6.8
3	25	7,400	9.8	41	6,200	23.2	103	6,800	13.2
4	28	9,000	19.6	44	9,200	25.6	100	10,200	24.8
5	45	7,600	9.6	90	9,400	20.0	105	9,200	18.0
6	22	9,000	20.4	68	7,600	21.2	70	8,600	16.0
7	10	7,000	18.4	23	6,600	30.0	103	16,400	21.2
8	34	9,200	4.0	37	8,800	23.2	78	5,600	7.6
9	20	6,200	27.6	57	6,800	43.6	103	9,800	28.4
10	20	6,400	.8	55	6,400	21.2	104	7,800	1.6
11	32	6,800	22.0	32	6,800	22.0	80	8,800	13.6
12	27	6,200	2.0	25	3,800	4.1	30	8,600	.8
13	14	4,200	8.4	14	4,200	8.4	109	10,800	2.0
14	16	7,800	18.3	59	11,200	46.0	101	10,200	28.4
15	11	19,200	20.8	110	7,800	35.6	110	7,800	35.6
16	20	6,700	12.8	26	5,000	21.4	90	7,400	3.2
17	9	9,200	1.6	11	11,000	2.8	15	19,400	[1] .4
18	16	5,400	.4	80	9,000	6.8	82	6,400	3.6
19	28	7,400	10.0	90	6,400	12.0	103	17,800	6.4
20	22	9,800	15.6	39	7,800	16.0	70	9,600	6.0
21	13	6,300	6.4	89	6,800	28.0	102	6,400	14.8
22	12	5,200	8.0	52	7,200	16.0	104	4,200	7.2
23	14	9,000	.4	20	4,800	6.0	80	7,000	2.4
24	20	9,800	4.4	75	9,400	16.0	90	7,000	10.4
25	22	3,200	6.8	22	3,200	6.8	100	6,800	1.6
26	52	9,400	20.8	52	9,400	20.8	100	6,800	10.0
27	24	3,400	8.8	54	5,000	20.0	100	9,000	7.4
28	11	3,200	14.0	73	5,200	42.8	101	10,600	24.8
29	24	7,400	15.2	40	6,000	24.0	61	5,000	14.4
30	24	7,800	10.4	55	6,200	10.8	103	8,000	4.8
31	29	7,800	8.4	83	8,000	28.0	83	8,000	28.0
32	19	6,400	16.4	32	6,800	46.8	86	7,400	26.8
33	9	14,600	6.8	15	11,600	20.8	15	11,600	[1] 20.8
34	24	.....	20.4	31	7,600	31.6	62	10,000	18.4
35	23	6,000	6.4	23	6,000	6.4	77	4,000	5.2
36	12	4,600	5.2	66	6,200	20.8	101	7,400	8.6
37	15	12,600	10.0	75	13,600	16.4	100	11,400	4.4
38	10	8,600	.8	41	7,600	9.2	85	5,200	1.6
39	13	6,600	1.2	92	7,000	12.8	92	7,000	12.8
40	21	5,000	15.2	55	13,000	44.0	84	7,000	35.6
41	9	5,800	4.8	89	12,000	44.0	101	9,400	26.4
42	31	17,600	2.0	41	18,400	3.2	34	11,400	[1] .4
43	20	11,000	8.6	101	8,200	14.4	101	8,200	14.4
44	40	7,400	20.8	46	5,000	23.2	100	9,000	14.0
45	16	7,400	4.8	62	7,600	19.2	62	7,600	19.2
46	35	8,200	4.0	70	9,200	6.0	104	5,800	4.8
47	32	5,000	10.8	32	5,000	10.8	102	7,800	4.8
48	26	4,800	26.0	80	9,000	33.6	102	7,200	29.2
49	26	5,800	11.2	77	9,400	17.2	77	9,400	17.2
50	27	15,200	2.4	91	6,400	24.8	102	7,600	18.8
51	20	6,000	6.0	70	5,600	18.0	83	4,200	4.4
52	25	13,400	20.4	100	8,000	22.0	100	8,000	22.0
53	25	6,200	7.6	85	11,200	9.6	109	8,000	8.0
54	40	4,200	17.0	104	5,800	35.2	104	5,800	35.2
55	39	5,400	26.4	43	11,800	28.8	100	15,600	11.6
56	33	6,000	13.6	64	4,800	28.0	103	9,400	13.6
57	56	12,600	14.4	83	12,200	31.6	83	12,200	31.6
58	65	7,200	9.5	65	7,200	9.5	107	9,000	7.2
59	18	11,200	4.8	16	5,600	8.4	75	7,400	4.4
60	19	10,800	6.8	66	7,200	24.8	.....	8,600	16.0
61	22	8,200	2.0	87	11,200	26.8	87	11,200	26.8
Average	24.3	8,000	10.85	57.4	8,013	21.24	87.1	8,921	13.71

[1] Died.

LYMPHOCYTES, LARGE AND SMALL.

In our counts we have preferred Cabot's classification to Ewing's, from motives of convenience, there being apparently no essential question involved as to increase or diminution of the percentage of "large mononuclear leucocytes." All leucocytes were called small if

below 10 microns in diameter, and all large above that size. There seems to be a decided tendency to increase in the proportion of large lymphocytes in some cases.

"STIMULATION CELLS" OF TÜRCK.

These cells were looked for at first, but were counted as lymphocytes. In two or three weeks, however, after beginning our special cases in Utuado we began to note them separately and many fine specimens were seen. Their great irregularity in appearing does not lead us to think that any deductions can be made concerning them in this disease. They were present in 49 of 51 of the Utuado series and their average percentage was 4.8.

MYELOCYTES.

In 43 of 51 cases in the Utuado series myelocytes appeared. The average percentage of these cells was 1. They were generally eosinophilic, as above stated.

BASOPHILES.

These cells appeared to be increased at times. Basophilic granules appeared rather frequently in lymphocytes.

In general conclusion, we cite the average percentage of the four chief classes of leucocytes in 29 cases before treatment was begun, and in which 10 per cent of eosinophiles or over was observed:

Eosinophiles	17.1
Polymorphonuclears	54.5
Small lymphocytes	16.3
Large lymphocytes	8.6
	96.5
Other leucocytes	3.5
	100.0

According to Ewing the total leucocyte count may vary, in normal blood, between 24 and 29; according to Cabot, between 24 and 38. Our total is 24.9, which rather approximates the lower than the higher limit, but is still within the normal. Our percentage of small lymphocytes is lower than normal according to both authorities, and our percentage of large lymphocytes is decidedly above the maximum of normal, according to Ewing. Therefore it would seem as though the large lymphocytes had gained at the expense of the small.

The polymorphonuclear neutrophiles seemed to have lost decidedly (normal, 62 to 70 per cent—Cabot; 70 to 72 per cent—Ewing), and the eosinophiles to have gained about what the first named have lost. As will be observed, there is generally no eosinophilic leucocytosis.

NERVOUS SYSTEM.

THE MENTAL CONDITION.

Over all the varied symptoms with which the unfortunate jibaro, infected by uncinaria, is plagued, hangs the pall of a drowsy intellect, of a mind that has received a stunning blow. There is, to us, no one symptom at once so characteristic and so pitiable. A benumbing in-

fluence seems to be exerted on the mental faculties even before anemia and heart changes are noted. There is a hypochondriacal, melancholy, hopeless expression, which in severe cases deepens to apparent dense stupidity, with indifference to surroundings and lack of all ambition. We believe the expression of countenance in a well-marked case, together with puffiness of the face and the peculiar color, to be very suggestive and not common to all anemias. Many of our patients stated that they came to our hospital expecting to die.

There is but one way of portraying the facies of an uncinarial anemic and that is to recount case by case the actual words used by us in describing their facial expression when they first came under our notice. This has an especial value because the terms used were employed under the most varied conditions and the observations are separated by long periods of time.

The Ponce series of 1899.

Heavy, leonine.
Very dull; he can not understand the simplest question.
Very poorly developed mentally with a passive expression.
Intellect limited.

The Ponce series of 1902.

Hypochondriacal.
Passive, characteristic, stupid.
Passive, quiet, pleasant.
Apathetic.
Stupid.
Most decided apathy.
Placid.
Listless.
Very downcast and passive; takes interest in nothing.
Exceedingly dull of comprehension.
Passive.

The Utuado series of 1904.

Cast down.
Very typical facies.
Miserable and cast down.
Hypochondriacal.
Very peculiar, half sullen, half melancholic expression.
Melancholy and dispirited, with a hopeless, staring expression.
Sad and dispirited expression.
Dull and torpid, always lamenting his poverty and sickness.
Dispirited and lifeless.
Staring.
Beyond description; very hypochondriacal; completely hopeless and querulous.
Neurasthenia of the worst sort, with a worn, dissatisfied, excited expression.
Depressed, anxious, and hypochondriacal.
Sad and dispirited.
Extremely despondent.
Hypochondriacal; very peevish.
Depressed and quiet.
Almost melancholic.
Downcast and apathetic.
Stupid and depressed.
Good.
Usual hopeless expression.
Depressed and hysterical.
Melancholy and lifeless.
Downcast and hypochondriacal, with a bewildered air.
Great mental depression; seems stupefied.
Weazened.
Weazened and woeful.
Very melancholic.
Bewildered and downcast.

TYPICAL FACIES, MAN AND BOY.

TYPICAL FACIES.

Cast down and lifeless.
Obtunded intellect; apathetic and timid.
Bewildered.
Pleasant.
Stupefied; dazed.
Very depressed and nervous.
Deeply suspicious of the doctor and prepared for the worst; hopeless.
Depressed and lifeless.
Old; drawn; pinched; appearing to be about 50 years of age (is 30).
Passive.
Very dull; frightened.
Indifferent and lifeless.
Dull, morose, and apathetic.
Very nervous.
Picture of misery.
Sad and lifeless.
Very dispirited.

With this data as a basis we can certainly describe the victim of uncinariasis as a man who has the appearance of being "drugged." To further emphasize this description, the following dialogue between the patient first applying for treatment and his physician may be of interest because it is so typical:

What is your name?
Umph?
I say, what is your name?
What is my name?
Yes; what is your name?
Juana.
Juana what?
Juana Maldonada.
What is the matter with you?
What is the matter with me?
Yes; what is the matter with you?
I get tired.
Where do you live?
Who—I?
Yes; you; where do you live?
Over there (pointing toward the mountains).
In what barrio?
In what barrio?
Yes; in what barrio?
El Asomante. (Etc., etc.)

Let it be understood that this is a typical case, rather severe. That the stupidity is merely apparent is seen from the almost universal fact that on being cured these questions are promptly and intelligently answered. The jibaro is not at all stupid; he is astute but unschooled, and the vast majority are not as slow to understand as the example given; but for the very reason that this is a frequent example of what we mean by apparent stupidity we have cited it. In addition it will be noted that the question is repeated in the same words as those used by the examiner. This echolalia is a very noticeable symptom indeed.

While this examination is going on the distinct effort made by the patient to concentrate his attention on what is being said to him is really painful, as it is clear that if the question were not repeated with an emphatic, decisive air it might never be answered. Here, again, we note another bit of evidence: In the severest forms true dream states occur, and they have to be veritably awakened to answer. Another mental condition is amnesia. Patients who have been stolidly staring at us while we were explaining how the medi-

cine should be taken will beg us to write it down, "as I can't remember the simplest thing," with a silly laugh. In bad cases there is real paralysis of thought. Their undecided timid mien bears out their mental condition; when they are given their instructions as to how the medicine should be taken, etc., they have to be told to go away and get it, signaling several times the place. Hypochondria in the midst of this narcotic state is a curious interpolation, but it is nevertheless a very palpable fact; their expression frequently shows it, and their remarks prove it. Melancholia, or, as a Porto Rican alienist puts it, "pseudomelancholia," is extremely common, and tinctures the mental state of nearly every one of those whom we are authorized to consider as suffering mentally from the effects of infection.

This is the mental state of the man whom many an unjust foreigner labels lazy, lacking in initiative, stupid, degenerate, etc.

From this deplorable state of mind it is but a step to more pronounced neuroses. First and most common is the well-known "ataque" or "nervous attack." All "ataques" are not caused by uncinariasis. There are the usual quota of highly nervous people in the island common to all southern countries, but the majority of such cases in the otherwise stolid jibaro are due to uncinariasis. When a woman of the mountains gets an ataque everyone turns in to help, and between all talking at once and trying to do things for her she reaches a state, if not cataleptic, at least one very similar. Preceded by a period of melancholia, suddenly a loud, long cry or a series of cries is emitted, and the patient falls (carefully), stiffens out, becomes purple, rigid, quiet, immovable, only to follow with a series of clonic convulsions thereafter. This latter stage is prolonged way beyond the usual time of an epileptic attack, which it roughly simulates, and all neighbors and friends pile on the unfortunate patient to hold her down. Now succeeds a period of logorrhea, in which the patient tells the most remarkable stories, displaying a loquacity entirely at variance with her normal character, uses the most vile and abusive language, and upon being addressed by any of the observers catches upon a word or expression and with this as a basis enters abruptly into the most elaborate texture of words bearing upon this expression. At such times the appearance of the patient is one of a truly insane subject. The attack passes away in a trance-like condition. They arouse with enough remembrance of what has happened to recount events that seemingly were acts of insanity. This ataque can be often called "hystero-epilepsy" and is all too frequent in Porto Rico. From this point on we enter into the realm of the alienist, but before submitting their evidence we wish to affirm that uncinariasis does not cause true insanity as often as might be believed, but in reality a series of the most varied and remarkable neuroses, which are often diagnosed insanity, but are not. The director of the insular insane asylum stated to us in a personal conversation that a large percentage of the insane patients sent him from different parts of the island were simply cases of uncinariasis.

And now, to consider the cases which are admitted as insane, and who are, in fact, although perhaps but temporarily, insane:

In a paper written by Dr. Eliseo Font y Guillot, assistant director of the insular insane asylum, entitled "The rôle played by uncin-

ariasis in the causation of some psychopathias and the syndrome pertaining thereto," we find the following:

As the nature of infectious diseases and those affecting nutrition become more patent, we see more clearly that the accumulation in the organism of certain poisons, resulting from disorders of assimilation and from the absorption of certain toxic substances engender, among other causes, nervous and mental affections which up to a very recent date were clinically interpreted, at times arbitrarily and whimsically, as diathetic or sympathetic insanities, or reflex gastric or intestinal neuroses. To-day we know that these affections are clothed in the habit of a mental confusion in which intoxication of the cerebral cells is proven, and to these belong pseudo-hysterics and pseudo-choreics with the family of tics so common in the victims of uncinariasis. This I have observed in almost 100 cases in the insane asylum of San Juan.

He compares the confused state of the anemic from uncinariasis to the typhoid state, and speaks of a true cerebral "impotence" with disassociation of ideas, with at times, visual and acoustic hallucinations, and a mania which is generally religious. He calls attention to the fact that these psychic states are only pseudo-manic and pseudo-melancholic differing from the real affections in that the latter are continuous and the former are only temporary.

True melancholia is due to a moral trauma, while the pseudo-melancholia of the victims of uncinariasis is only a sort of mental confusion combined with catatenic phenomena.

He states that from the many varieties of uncinarial insanity we can define two types: One in women, or hysteria; the other in men of choreic quality allied to the tics, and both interrupted by alternating delirium and hallucinations.

The hysteria mentioned may be summed up in the expression "dream state." The form in which choreic states are manifest is demonstrated by borborygmus, hiccough, uncontrollable laughter or sobs, logospasms, eructation of feces, etc.

To conclude, and in conformity with the fact that there exists clearly, definitely, and concretely an uncinarial mental confusion, I assert that it is enough to give the usual anthelmintics employed for the expulsion of the worms and we see our patient restored to complete mental health.

The most notable case of Dr. Francisco Goenaga, ex-superintendent of the insane asylum, the details of which he has kindly furnished us, should receive special attention: C. P., female; accused of murder; placed in the insane asylum November 19, 1902. She was then suffering from mania with hallucinations and from the most profound grade of anemia.

Little by little ferruginous, arsenical, and other tonics, aided by needle baths, exercises in the open air, and proper food bettered her mental condition a good deal. But she remained a victim of anemia until, aided by my distinguished colleague, Dr. Don Pedro Del Valle Atiles, the uncinaria duodenalis was discovered by microscopic examination. I proceeded to their expulsion. In a surprisingly short period (three months) a complete regeneration of her blood was obtained, which effected at the same time a cure of her mental condition. The 27th of June, of this year, it was possible to hold the trial which had heretofore been in suspense. She was declared innocent by the district court and returned to her home in Rio Grande.

We close our remarks on the mental condition of the Porto Rican anemic by citing a personal case of Dr. Pedro Gutierrez. Ramon S., 24 to 26 years of age, white, single, peon and ox-cart driver in a sugar plantation near Bayamon, was suddenly attacked by acute mania which turned out to be persecutory, and which obliged his employer to

deliver him over to the municipal authorities for confinement. His treatment there consisted of the administration of a purge and a cold douche. He quieted down, but was later seized with another wave of mania and broke his arrest, escaping to the plantation where he was employed. At this time Dr. Gutierrez saw him. He appeared to be then suffering from melancholia; expression stupid, gaze fixed on space, extreme pallor, tongue heavily coated, and breath stinking, and all the severe circulatory phenomena, with bruit-de-diable in the veins of the neck. On inquiring of the family the history of the case he was told that previous to the outbreak of mania the man had suffered from extreme melancholia, gradually developing the idea that he was to be supplanted by another farm hand, and that he was to be thrown out on the world. This ended in his walking about at night in the plantation with an umbrella over his head muttering to himself and at times shouting commands at an imaginary team of oxen. Without waiting for an examination of the feces, for the case was clear and the necessity pressing, thymol was given after the preceding purge and from the next day the man began to improve. In two weeks all mental symptoms had disappeared and in six weeks from the time thymol was first administered the man was an enormous, powerful, ruddy, and perfectly sane man. He married and is known now in the barrio, where the cure made a great impression, as "Ramón el loco," "Ramon, the crazy," in commemoration of his sensational visit to the town jail and because the night he was confined the authorities had made out commitment papers for his transfer to the Insular Insane Asylum.

SOMNOLENCE.

This is at times marked. In one instance, two children, brother and sister, patients in the hospital, passed their entire time sleeping. Their blood was examined for trypanosoma, but the result was negative. Although we had several other cases of somnolence, in general, insomnia was the usual complaint.

Somnolence occurred in 2 of the Ponce series of 1902, 2 of the Utuado series of 1904, and 2 of the Rio Piedras series of 1906; a total of 6 in 92 cases, or 6.5 per cent.

Insomnia occurred in 9 of the Ponce series of 1899, in 4 of the Ponce series of 1902, in 21 of the Utuado series of 1904, and in 5 of the Rio Piedras series of 1906; a total of 39, or 35.1 per cent.

HEADACHE.

This is very frequent. It is generally temporal and frontal, but pain in the vertex and cerebellar region is not rare. The prevalence of this symptom is seen in the tightly wound cloth about the forehead, so often encountered in this country.

In the Ponce series of 1899, 9 suffered from headache; in the Ponce series of 1902, 9. In the Utuado series of 1904, 56 complained of headache. In 23 of these it was general, frontal in 16, temporal in 8, fronto-cerebellar in 1, temporo-frontal in 6 and temporo-cerebellar in 2. In the Rio Piedras series of 1906 there were 11. Two had general headache, 3 temporo-frontal, temporal 2, temporo-occipital 1, frontal 2, and parietal 1. This makes a total of 85, or 76.5 per cent of 111 cases.

NEURALGIA.

Neuralgia occurs but it is not common. It is usually confused with headache, joint pains, muscle pains, etc.

In the Ponce series of 1902 there were 4 cases of neuralgia, and in the Utuado series of 1904 there were 9. These cases are irrespective of headache, some cases of which may well be considered neuralgic.

THE PATELLAR REFLEX.

This is very often diminished or entirely abolished, a frequent condition.

In the Ponce series of 1902 the patellar reflexes were exaggerated in 4 and diminished in 6 cases. In the Utuado series of 1904 they were slightly dulled in 2, much dulled in 7, abolished in 31, and exaggerated in 5. In 80 cases, therefore, they were exaggerated in 11.2 per cent, dulled in 18.7 per cent, and abolished in 38.7 per cent.

TACTILE SENSIBILITY.

This is often impaired, but was not carefully investigated in most of our cases. It was found to be decidedly blunted in 3.

IMPOTENCE.

This is exceedingly frequent and in bad cases is almost always complete.

In the Ponce series of 1902 there were 15 men of an age in which this symptom can be considered; 4 were partially and 7 completely impotent.

In the Utuado series of 1904 there were 26 men with the above conditions, of whom 17 were completely impotent.

This gives a total of 41 males, of whom 58.5 per cent were completely impotent and 9.7 per cent were partially so, a total of 68.2 per cent partially or completely impotent.

AMENORRHEA.

This is fully as frequent. Of the 8 women of age consistent with menstruation in the Utuado series of 1904, 7 had amenorrhea. This is borne out in the clinic, where even in the moderate cases this is a most frequent symptom.

Of the 9 women who had reached the childbearing period, 3 had had abortions and 1 of these had aborted three times. Stillbirths cause havoc among women in Porto Rico.

SUSCEPTIBILITY TO COLD.

This is a common symptom. The nights in the mountains are often quite cool (even as low as 53° F. has been registered in the year 1903), and the complaint of being "frozen" is very common. Susceptibility to heat is much less noticeable.

Susceptibility to cold was the subject of complaint of 11 of the Ponce series of 1902, and of 36 of the Utuado series of 1904; a total of 47 of 80 cases, or 58.7 per cent, and to both heat and cold by 5, or 6.2 per cent.

PARASTHESIAS.

Parasthesias are almost general. Tingling and formication are the most notable. Such expressions as "se me mueren las piernas" (my legs feel dead), and "tengo un hormigueo en los pies" (I feel as though ants were crawling on my feet), are often heard. These sensations may extend to the arms or may even become general.

Twelve of the Ponce series of 1902 stated that they suffered from parasthesias. This was a symptom in 32 of the Utuado series of 1904, a total percentage of 55. Among the 32 Utuado cases there were 9 who said that they generally had these sensations in the feet and legs, 3 in the feet alone, 2 in the legs alone, 1 in the hands, and 20 who stated that the sensations were generalized throughout the body.

THE EYE.

Unfortunately, we did not make a careful study of the eye grounds. Every year our time was entirely taken up with the collection of the data herein set forth, and we had to content ourselves with noting subjective symptoms and scattered objective ones.

In the Ponce series of 1902, 15 complained of "colored images before the eyes," 11 of blurred vision. Of this series 16 gave symptoms referable to the eye.

In the Utuado series of 1904, 43 had visual disturbances, 34 blurred vision, 7 blurred vision with excessive dilatation of the pupil, 1 of excessively dilated pupil, blurred vision, and night blindness, and 1 of blurred vision and night blindness.

In the Rio Piedras series of 1906, 5 had blurred vision.

Thus, of 92 cases, 64, or 69.5 per cent, had more or less serious disturbances of the eyes. We can not doubt that much of this was due simply to the degree of anemia, but there remains a considerable percentage both of these cases and among a large number seen in the clinic who had more or less marked visual affections with very little anemia.

Maj. W. F. Lippitt, United States Army, examined the eye grounds of 10 of our cases in 1904 and found evidence of old retinal hemorrhages in 2, which he very kindly demonstrated to us. The fundus is generally very pale and the retinal arteries small.

Fischer and v. Nieden state that 7 to 8 per cent show eye-ground changes.

Loebker and Bruns remark on the pallor of the eye grounds and state that there may be pulsation of veins, lowered intraocular pressure, pronounced convolution of veins, and, commonly, retinal hemorrhages. According to v. Nieden, a much cited observer, these signs of hemorrhage appear in long streaks or in spots corresponding to the course of the ocular vessels, with more or less signs of fatty degeneration. They add that it is rare to observe changes corresponding to those found in albuminuric retinitis. Many authors speak of edema of the optic papilla.

Siccardi notes nystagmus, diplopia, amblyopia, muscular and accommodative asthenopia and restriction of the field of vision. He states that Rampoldi, who first called attention to the changes in the eye grounds, found exudative retinitis of the same variety as that described by Liebreich in leucemia. Rampoldi observed a case of

sudden blindness in a young subject (19 years of age) with the usual signs of atrophy of the papilla. (See case 1330, Aibonito series, 1905; circumstances prevented a study of the eye grounds. We considered this to have been a hysterical state and to this we attributed the blindness. We may have been mistaken.)

Lutz mentions, as a rare sign, chemosis of the bulbo-palpebral fold. He had 3 such in 25 cases.

Fuchs found small, whitish spots, due probably to old retinal hemorrhages.

Siccardi, from an observation of his cases, comes to the conclusion that the changes he saw speak loudly for a nephritis. He admits the possibility of a simple anemia being the cause of pallor of the retina, edema, and hemorrhages, and likewise acknowledges the reason for attributing functional disturbances of vision to the reflex action on the eye from the irritation caused by the attached worm in the intestinal canal, but there are, he thinks, other changes that can not be explained by reflex stimulation or by simple anemia, and such are those demonstrated by a retinitis. Where retinitis is found with atrophy of the optic papilla a general affection is to be considered; in other words, a circulating poison. He avers that it is his belief that the changes of this nature are produced by a toxin, just as alcohol, lead, iodoform, etc., cause such lesions.

Night blindness is not a symptom to be ignored. Thornhill reports that he found it in 9.5 per cent of his cases, and Swan and Nell in 24 per cent of theirs (!). Only our special cases were questioned on this point, but three of our general series volunteered the information that they suffered from it.

Case 15 of the Ponce series of 1902 suffered from night blindness and partial amaurosis, and 6 and 8 from night blindness alone, a total of 3 in 80 cases, or a percentage of 3.7 in 80 cases.

Nystagmus is a rarer symptom which we have several times observed. Case 15, cited above, is a good example.

Cataract.—A most interesting observation is its great prevalence in Porto Rico, not only in the old, but sometimes in the young. Maj. Lippitt, whose experience is large, states that fully three-fourths of his cases in Porto Rico were anemic. A. W. Calhoun (Ophthalmologic Record, new series, Vol. XII, No. 7, Apr., 1904) calls attention to the occurrence in several of his cases of a double, chalky-white cataract, beginning a short while (one year) after the establishment of uncinariasis. One was a boy 14 years of age, where the condition began eight months after the disease, and another a boy 16 years old.

Corneal ulcers are also reported. One such case was observed in the Ponce series of 1899.

We made a special effort to corroborate Stiles's observations on the pupil, and found, indeed, a decided tendency to its dilatation. But the patient is weak, dizzy, and sick, and although we have not seen that writer demonstrate how he obtains the phenomenon described, we can not believe it to be diagnostic. The fact is, in trying to demonstrate this symptom, we nearly hypnotized some of our patients. Stiles says: "If the patient is directed to stare intently into the observer's eyes, there will be noticed a symptom which it is difficult to describe, but which I have found more constant than almost any other noticed, namely: After a moment, the length of time apparently varying

slightly, according to the degree of the disease, the pupils dilate and the patient's eyes assume a dull, blank, almost fish-like or cadaveric stare very similar to that noticed in cases of extreme alcoholic intoxication." He states that he does not go to the extent of considering the stare diagnostic of uncinariasis. We certainly do not consider this a prominent symptom per se, but the dilatability of the pupil is noticeable and goes to make up the tout ensemble of a facies which is very suggestive of uncinariasis. The expression in moderate and marked cases, as will be noticed by the cuts in this report, is habitual and need not be elicited in this manner. Not only this, but we may consider ready dilatability of the pupil a symptom of infestation by many varieties of intestinal parasites.

THE REPORTS OF THE PORTO RICO ANEMIA COMMISSION.

AN ACT To provide for the study and suppression of the disease known as anemia in Porto Rico.

Be it enacted by the Legislative Assembly of Porto Rico:

SECTION 1. The governor is hereby authorized to take such measures as in his judgment may be most expedient to encourage the study and cure of the disease known as tropical anemia in Porto Rico.

SEC. 2. For the prosecution of the work, the construction of field hospitals, the employment of temporary help, purchase of medicines, instruments, laboratory supplies, and other incidental expenses, the sum of $5,000 is hereby appropriated out of any moneys in the treasury not otherwise appropriated, the said sum to be disbursed in such manner and for such purposes as the governor may direct.

SEC. 3. This act shall take effect form and after its passage.

Approved:

WM. H. HUNT, *Governor.*

EXECUTIVE MANSION, *February 16, 1904.*

LETTER OF TRANSMITTAL.

SAN JUAN, P. R., *December 1, 1904.*

SIR: We have the honor to submit the following report of the commission named by the governor of Porto Rico, by authority of "An act to provide for the study and suppression of the disease known as anemia in Porto Rico."

Owing to limitations of time and space, it was not found possible to produce it complete in both English and Spanish, but it has been so arranged as to give the substance in each language, though parts of particular interest to readers of one language are more in detail in that language.

Respectfully,

BAILEY K. ASHFORD, M. D., *Georgetown University,*
Captain, Assistant Surgeon, United States Army.

W. W. KING, M. D., *University of Louisville,*
Passed Assistant Surgeon, United States Public Health and Marine-Hospital Service.

PEDRO GUTIERREZ IGARAVIDEZ, M. D., *University of Seville,*
Health Officer of Bayamon, and Director of Municipal Hospital.

Hon. BEEKMAN WINTHROP,
Governor of Porto Rico,
San Juan, P. R.

JIBAROS UNDER TREATMENT, FIELD HOSPITAL, BAYAMON, 1904.

THE FIRST REPORT OF THE PORTO RICO ANEMIA COMMISSION.

* * * * * * *

The method to be pursued was left entirely to the discretion of the commission, and it was decided that a formal organization would be unnecessary but that all matters would be informally discussed as occasion should arise. It was determined that no member should devote himself exclusively to one or several phases of the work, but that they should participate equally in all details, so that the conclusions finally drawn would represent the consensus of opinion of three individuals working along the same lines. Thus every observation would be confirmed by two others.

By approval of the War Department, the Surgeon General of the Army lent to the insular government the hospital tents, cots, bedding, and practically all of the camp equipage and utensils. Each member provided his own instruments and laboratory outfit. Had the commission been obliged to purchase these articles out of the appropriation, there would not have been left sufficient money to carry on its operations. Even with this assistance, it was necessary to practice the strictest economy in all expenditures. Needed technical assistants, clerks, etc., could not be employed.

The commission recognized that it was undertaking a delicate and arduous task, not only on account of its limited resources, but in the management of a class of people naturally suspicious of innovation and apprehensive of being made subjects of experimentation. We were advised that they were too ignorant to properly take the medicine in their homes; that they would not sleep in tents for fear of dampness and exposure to night air; that they were too irresponsible to be depended upon to return regularly for treatment. All of the members of the commission speak Spanish and have considerable knowledge of the peculiar dialect and idioms of the "jibaro." By the exercise of tact, patience, and kindness, we gained their confidence and faith, so that they would talk to us freely. We found them easily managed, respectful, obedient, deeply grateful, and much more intelligent than is generally believed, even in Porto Rico.

Many considerations led to the location of the hospital first at Bayamon. It was accessible to San Juan, our base of supplies. Rooms and beds for some patients in the Bayamon Municipal Hospital were placed at our service. It was desired to give the physicians of San Juan an opportunity to observe the practical work and the results of treatment. We regret that many were unable to visit the camp.

The site selected was in the rear of the Municipal Hospital, and was located in a field sloping toward a small stream beyond. In spite of heavy rains the interior of the tents remained dry and comfortable. In fact, the tent hospital proved a complete success.

Authority for the use of the tents, etc., was received by cable March 7. They were transported from San Juan to Bayamon, pitched, and ready for use by the 14th. Each tent had a portable floor designed for us by Mr. Scott Truxtun. Two large sills supported in notches smaller cross pieces, on which the flooring was laid. No nailing was necessary, yet it was always steady, easily laid, or taken up. Each tent contained six folding hospital cots, except the dining and the administration tents. Along the bank of the stream a row of eight tents was placed facing the one used for the dining room, and between the latter and the Municipal Hospital building was placed the administration tent. At a convenient distance, in one corner of the field, privies were placed. The pail system was used, and each night the cans were carried to a distant field, the contents buried, the cans washed, limed, and dried before re-use. The privies, made of palm bark, were burned after removal of the hospital.

Food for the patients and employees was cooked at the kitchen of the Municipal Hospital, and in the same building were located the office, dispensary, and laboratory of the commission.

The personnel at Bayamon was:

	Per month.
Apothecary	$50
Housekeeper	20
Nurse, male	6
Nurse, female	6
Cook	4
General helpers (2 at $4 each)	8
Scavenger	12

Treatment of patients at Bayamon began on March 6 in the Municipal Hospital and continued until April 30. During this period 951 cases of anemia were treated. Persons applying for medicine were required to bring, for microscopic examination, a small specimen of their feces. This fact soon became general knowledge, and they usually came provided.

Patients were first examined for the uncinaria. In 947 of the 951 cases it was present and was the sole cause of anemia in nearly all cases, a few having some contributing cause, as advanced tuberculosis, chronic dysentery, etc.

The presence of the parasites having been determined, the patient was sent to another room where the hemoglobin was estimated and the percentage recorded. A full clinical history was attempted in each case until increasing numbers at the daily clinic made it a physical impossibility, and we were compelled to limit ourselves to a record of hemoglobin and certain other information to be used in this report. Even after it was decided to move the camp to Utuado we continued to admit new patients in order to give them the benefit of even short and incomplete treatment, but we did not estimate their hemoglobin as the short time rendered such record of no particular value. There were 304 such cases and 19 others in which the hemoglobin was not recorded.

Patients were given a prescription which they presented to the apothecary who delivered the medicine with directions as to how it should be taken, the patients, or those accompanying them, being required to repeat these instructions until they were thoroughly understood. They were directed to return in one week for reexamination

FIELD HOSPITAL AT UTUADO.

and more medicine, most of them doing so with more or less regularity. This fact alone is an eloquent testimonial of the efficacy of the treatment. Had they not felt better, they would not have continued to come long distances on foot, as many did.

The hospital was used for patients who were unable to return to their homes, or who were so ill that we wished to have them under our personal observation while taking thymol. The latter class, as a rule, remained only three or four days in hospital, when they were discharged to give room to others. The majority of cases, both in Bayamon and Utuado, never were in the hospital and never received any food from us. Patients in the hospital were subsisted by the commission, but no attempt was made to forward their recovery by extra diet. They received a sufficient quantity of good food and were satisfied.

At the request of the alcaldes of Naranjito and Toa Alta, visits were made to these towns on March 19 and April 9, respectively, and a large number of anemics were examined at each place. They were invited to come to the hospital at Bayamon, and many did so. It was our intention to establish substations at these near-by towns, but the members of the commission were too busy to visit them regularly and the plan was abandoned.

Our operations at Bayamon closed April 30. The vast majority of patients then ceased to come, but some desired further treatment. Dr. A. Stahl, of Bayamon, who had been working with the commission, was left in charge and supplied with medicines to treat such patients who continued their visits. His services continued until June 15, and the results in these cases have been included in the Bayamon statistics.

From May 1 to 9, we were occupied in moving the camp to Utuado, one of the most "anemic" districts of the island. Considerable delay was caused by the difficulties of oxcart transportation from Arecibo to Utuado, but on the 9th the hospital was ready for occupancy, and the treatment of patients begun.

The commission had previously visited Utuado and selected the hospital site, which was located in a field of high rolling ground across the Viví River from the town. The soil was sandy loam and so well drained that it never became muddy. The tents were arranged in the form of a rectangle, four on the long sides, with one at each end between the lines. One was used for a dining room. The former administration tent, being no longer needed as such, was converted into a bed tent, thus increasing the capacity from 48 to 54 beds. The same privy system was used.

Some 200 yards from the hospital was a large country house rented by the commission and used for quarters of employees, clinic rooms, dispensary, laboratory, and storerooms. Food for the camp patients and employees was cooked at the kitchen of the house.

The personnel at Utuado was:

	Per month.
Apothecary	$25
Housekeeper	20
Nurse, male	8
Nurse, female	4
Cook	4
Scavenger	9
General helper	4

In the organization of the work in Utuado, profiting by our experience in Bayamon, we were able to improve and better systemize our methods. Each patient was given an identification card giving case number, name, and residence. This card impressed upon the patient that he was under obligation to return at the time specified and possibly explains, in large measure, why the Utuado cases returned with greater regularity than those at Bayamon. The record books were numbered to correspond to these cards, so that, when a patient returned, his previous record was easily found. Notes on condition, microscopic examination, treatment, etc., were entered at each visit, and in this way the information regarding the Utuado cases was made more complete than at Bayamon.

Anticipating that a large number of patients would be treated, it was decided not to attempt to take the percentage of hemoglobin on entrance and at each visit, except in special cases. On some days between 500 and 600 patients were examined and treated, and to have estimated the hemoglobin of each would have left no time for other things. At Bayamon the hemoglobin was recorded on entrance to show the grade of anemia, and the Utuado cases averaged about the same, or worse, if there was any difference. The weekly records of a series of special cases at Utuado (see appendix) were illustrative of the changes occurring in the other cases at Utuado and Bayamon. These special cases were a series of typical ones, in which a weekly record of hemoglobin percentage, counts of red and white cells, and differential leucocyte count was made.

The general procedure at Utuado was the same as at Bayamon with the exceptions noted.

Patients began to arrive early in the morning, in many cases having traveled since the day before, generally on foot, resting from time to time according to their strength, and it was no uncommon occurrence for them to have been several days on the road. Very bad cases were carried in hammocks to the camp, 12 such being received in a single day, of whom 1 died the same night.

The patients, arriving singly and in groups, congregated in the large "patio," or yard, adjoining the house. They were admitted by small groups according to their turn, and frequently had to wait several hours, yet little or no complaint was made. The very ill and those from a long distance were given a preference whenever possible. On light days, we were able to finish the clinic by noon or 1 o'clock, but others required until 4 or 5 in the afternoon. The remainder of the day was occupied with the blood studies, patients in hospitals, etc., and most of the clerical work was done at night.

In the latter part of June, Dr. Tulio Lopez Gaztambide, of Arecibo, came to study and work with the commission. By this time, the work was becoming so heavy that we prevailed upon him to continue his valuable services until the end of our stay in Utuado.

There seemed to be no end of applicants for treatment. Beginning with 10 to 20, by the latter part of July, we were receiving from 125 to 150 new patients daily. The rate continued to increase, and these, with the old patients returning, made our clinic from 300 to 600 per day. Not to speak of the physical strain upon ourselves, it was too great a tax upon our time and funds. Considering that the old patients should be given the preference, and desiring to continue as long as we could, in order to cure as many as possible, announce-

A "HAMMOCK CASE" AT THE UTUADO STATION, 1904.

THE THATCHED SHED—OUR WAITING ROOM, DISPENSARY AT UTUADO, 1904.

ment was made that no new patients would be treated after July 23. After that date, only a few were received, generally very bad cases that we did not have the heart to turn away.

The same class of patients was admitted to the hospital in Utuado as in Bayamon. There were more of desperately ill ones, but not so many transient cases, as our experience in Bayamon proved to us that it was reasonably safe to allow thymol to be taken at home, even in severe cases. The patients on whom the weekly blood examinations were made were kept in the hospital or about the camp, if possible, in order to have them present at the proper time. The demand for beds soon became a serious question, as every day applicants came to whom it was impossible to refuse admission. To provide beds, the improved and least ill of the special cases were taken out of the hospital and given bedding, which at night they spread on the floors of the house. It was not ideal hospital management but a concession to urgent necessity, and even then many had better accommodations than they would have had at home. At one time there were more sleeping in the house and outbuildings than in the hospital.

The hemoglobin was taken when patients had expelled all their uncinariæ and appeared to have regained their normal color. If it registered 85 per cent or over they were considered cured of their uncinariasis and were discharged. The first case thus discharged was on June 11. The hemoglobin examinations were equivalent to handling that many additional patients, and as they became numerous, we were efficiently assisted in this labor by Mr. Octavio Jordan, of Utuado, a student at the Jefferson Medical College, Philadelphia.

During the last few days patients were told not to return, as our dispensary would be closed. On August 15 treatment of patients ceased, 4,543 cases of uncinariasis and 6 of anemia from other causes having been treated.

From August 15 to 19 the camp effects were packed for storage or shipment to San Juan. On leaving Utuado, we were much gratified to observe among the people of that city that the former skepticism as to the curability of the disease by medicine had given place to belief.

Through the kindness of Maj. W. F. Lippitt, surgeon in charge, the commission was provided with cool and commodious quarters in the Military Hospital in San Juan, and by September 1 had begun the task of classifying and tabulating the immense mass of data, preliminary to writing the report. Two months were spent before this was accomplished, and the remainder of the time was occupied in the formation of the report.

The commission, basing its opinions upon the result of its investigations which form the body of this report, has drawn the following conclusions:

The disease known as anemia, in Porto Rico, is only a symptom of some definite pathologic entity, or a consequence of some aberration of physiologic processes, caused by improper diet, unhygienic surroundings, etc.

The finding of a specific disease one of whose chief symptoms is anemia, and the disappearance of this symptom under treatment directed to the disease alone, while the general causes remain unmodified, lead us to believe that the anemia in Porto Rico is due, in the

great majority of instances, to this specific disease, i. e., uncinariasis or ankylostomiasis.

As is well known, this affection is caused by the presence of a small worm (uncinaria) in the intestines of the patient.

This parasitic worm gains entrance to the subject generally by penetration of the larva through the skin.

The disease is marked by profound anemia and degeneration of vital organs, leading to chronic invalidism, and often results in death.

About 90 per cent of the rural population in all parts of the island are affected.

The large number of sufferers must affect the social and economic status of the country.

The affection is curable in the great majority of cases, and is susceptible to restriction or elimination in proportion to the observance of elementary hygienic laws and the treatment and cure of those already afflicted.

The few cases in which anemia is symptomatic of other disease or condition are the same as in other countries and are produced by the same causes. As exceptions to the rule, they tend to strengthen our conclusion that the prevalent anemia in Porto Rico is a consequence of uncinarial infection.

* * * * * * *

[We omit the chapter on the history of uncinariasis. It is preceded by a definition of the disease and a résumé of the terminology applied to it since the earliest times.]

1. The great lurking places of the uncinaria of man are not fully exploited. In spite of an abundant literature, physicians are not yet acquainted with it, and many excellent practitioners are ignorant of all save one of the popular names of the disease and possibly a few clinical facts to identify it. In certain civilized tropical and subtropical countries, the same may be said with far less excuse.

2. There are countries where the disease is endemic among classes following certain pursuits, and where there is little danger of extensive spread. Such, for example, are Germany, Belgium, and France. As countries said to be infected, they can not be placed in the same category with Porto Rico and other parts where uncinariasis is the scourge of scourges, and is as fatal, if not more so, than yellow fever in its palmiest days.

3. There are regions said to be infected because a few straggling cases have been reported, but such cases are really imported into climates where neither occupation nor temperature will ever favor a spread of the disease.

4. Finally, there are places presenting favorable conditions for the development of this parasite, and which, by analogy, medical geographers have considered infected, but the parasite has not yet been demonstrated, and the clinical data are merely suggestive.

[We also omit the chapter on the parasitology, believing that by this time the publicity given to Dr. Stiles's painstaking work needs no repetition by us, apart from the fact that this is his field of research and we do not wish to encroach upon it.

Leaving, therefore, the purely zoologic discussion for men who have made this branch of science their lifework, we will consider the question of how man is infected.]

GROUP OF PATIENTS AT BAYAMON.

CHARACTERISTIC DWELLING OF THE POORER CLASSES OF THE COUNTRY.

FIELD HOSPITAL AT BAYAMON.

FIELD HOSPITAL AT BAYAMON.

MODES OF INFECTION.

There are two modes of infection; one, and until recently the only one known, by the ingestion of larvæ; the other, still doubted by many, through penetration of the skin by the larvæ and their subsequent migration to their point of election, the small intestine.

Infection by ingestion of larvæ.—Leichtenstern first clearly showed that infection per os is possible but, we think, erroneously considered this to be the usual mode. He found that in from five to six weeks the parasite became sexually mature, but fails to explain clearly how the little worm maintains its usual position in the jejunum until development is complete. Grassi believed that they encysted themselves on reaching their destination, a belief strengthened by Leuckhart, reasoning, by analogy, from the encystation of strongylus equinum in its host during its developmental stage.

As most authorities are agreed that this is at least a possible avenue of infection, let us call attention to some of the means by which our laboring classes might thus become infected.

It should be noted that all traces of human ordure have usually disappeared by the time infection takes place; thus man's natural disinclination to touch feces does not cause him to avoid infective material.

More than this, the larvæ are motile, and rains scatter them about, so that large nests of infection, as we may say, are dispersed over considerable area. We believe that we should emphasize the fact that it is usually in the immediate vicinity of his home, and even sometimes when the floor is of earth, inside the hut, that the jibaro is infected. He defecates "en el montecito," or, as we say, "in the bushes," and this montecito has become a synonym for privy. Owing to weakness due to the disease itself or to indolence, his excursions to the montecito become shorter and shorter and result in a general pollution, by himself and his family, of a considerable area around his home.

A jibaro hut is usually well shaded by banana plants, so we have shade, humidity, which is practically never lacking in such spots, and an ideal temperature.

Another heavily infected locality is beneath the coffee plant; coffee picking is at times interrupted by a call to stool, which is obeyed in the immediate vicinity. The coffee bush itself produces shade, being always shaded in turn by some tree or variety of plantain. Thus we have in every coffee plantation in Porto Rico a mass of liberated larvæ. The shade of a coffee estate admits no superior for an ideal culture medium. The quintessence of perfection is, however, only attained when a mass of decomposing banana leaves and stalks fall into a little depression in the dense shade. In a few days a rain comes on and a "charco," or little pool of water, forms. Certain "charcos" are popularly known and feared by the peons for reasons to which we will afterwards refer.

Sugar fields are not nearly so heavily infected as coffee estates because of two circumstances. The earth is plowed up every year and the sun acts powerfully upon it after the crop is harvested. One suffocates many larvæ by turning them under a heavy layer of earth, the other kills them by direct light, heat, and drying.

We have been entirely convinced that the observation of Stiles, that sand areas were practically the only ones infected, can not be sub-

stantiated here in Porto Rico. Sandy regions were not those which contributed the majority of our cases in Bayamon. On the contrary, the foothills were apparently the heavily infected parts. Bayamon, although near the sea, is not sandy. Cataño, a large settlement only an hour away, where every condition is afforded for a heavy infection of the inhabitants, only furnished 11 cases. On the other hand, very distant interior barrios contributed most of our patients. In order to determine the facts, we made a trip to Naranjito and other towns well elevated in the foothills, and were able to confirm our suspicions. Cataño, a purely sandy locality, is generally infected, but in the foothills, noted for a rich alluvial soil, the number of extreme cases of anemia is something beyond description and not to be compared with the cases seen in sandy barrios of the coast. Utuado is a sandy town, but we received the majority of our patients from barrios which could not really be so described. We therefore conclude that sand is not proven to be any better culture medium than alluvial deposits and clay, soils common in districts where it is difficult to find one single person not infected with the uncinaria. This should not be taken to mean that sandy districts can not be heavily scourged. All varieties of soil in Porto Rico can provide a good culture of larvæ if the infected feces are deposited under proper shade.

If we believe that infection takes place generally by ingestion of encapsuled larvæ, we only have to call to mind the manifold habits of life possessed by every people on earth who deal directly with the soil. Some of these may be specified as follows: Soiling the mouth with muddy hands at meal time; eating muddy vegetables and fruits; drinking muddy water; drinking from muddy receptacles; *inadvertently* swallowing muddy water while bathing in streams; earth eating; carrying muddy clothing home to soil the hands of wife and children; cleaning of muddy feet and transferring the infection to the finger nails; crawling of children in earth which they frequently eat; handling of mud-bedraggled dresses before meals; eating of sweets made in dirty, muddy houses; drinking of guarapo, the expressed juice of sugar cane. This list comprises by no means all of the possible modes of infection by the mouth.

The important point is, that, if infection by the mouth takes place, the mud ingested must be wet at the time. We have positive evidence from almost every observer who has cultivated the larvæ, and from our own culture experiments, that they die rapidly on drying. If infection takes place by drinking muddy water, that water must be exceedingly repulsive to contain more than one part of solid matter to the thousand, a proportion shown by Bruns to be fatal to the larvæ.

In our opinion, infection by the mouth is so restricted by the latter facts as to be a rarity indeed. We know of many instances of infection in well-to-do persons where it is not probable to conclude an infection through the ingestion of either mud or water, and in which an explanation can only be made by the fact of skin infection.

What, then, is the common route chosen by these small larvæ?

Infection by penetration of the skin.—[Under this heading the original report contained a description of the Looss demonstration in 1898 of the passage of the larvæ of ankylostoma duodenale through the healthy skin and the subsequent appearance in the stools of the ova of that parasite in individuals previously known not to

METHOD OF BRINGING IN VERY ILL PATIENTS. HAMMOCK CASE.

INTERIOR OF A HOSPITAL TENT.

HOUSE OCCUPIED BY THE COMMISSION AND PATIENTS WAITING TO BE EXAMINED.

have been infected. Following this was a résumé of Bentley's and Boycott and Haldane's clinical observation on the dermatitis coincident upon ankylostome infection and Claude Smith's human and Looss' animal experiments. All of this is omitted, as it is now well known, and we take up the thread of the report again in its application to what was then but a theory to many and at best a scientific fact unsubstantiated by any great number of cases such as our work, for the first time, was able to bring forward.]

* * * * * * *

It is believed that it will always be impossible to rigidly exclude other routes of infection, but we are also very positive of the fact, which further remarks will render all but certain, that infection by uncinaria of man, in this island, is generally contracted through penetration of the skin by the larvæ, and that, once having thus effected an entrance, they pursue a more or less direct course to the intestines, the point of election. This may seem strange to some, but it is no more so than accepted phenomena of similar nature, such as the migration of the embryo of trichina from the intestines to the muscles. It is certainly not as odd as the unexplained and weird pilgrimage of millions of embryos of filaria nocturna into the peripheral blood during certain hours of the night. In fact, we are accustomed to such behavior in the life history of many animal parasites of man and animals.

As to the chances offered the larva for effecting a lodgment in his human host, the skin is by far the most exposed. We are really unable to account in any other way for some infections we have seen.

The conditions under which the jibaro lives will be again referred to, but suffice to say that uncinariasis in Porto Rico is a chronic disease, with acute exacerbations occurring in the rainy season; that at this time most deaths occur from "anemia;" that the great sufferers from "anemia" are the unshod poor; that they themselves lay great stress upon the fact that "anemia" comes from the dampness of the soil which, they say, ascends through the soles of the bare feet and "chills the blood," causing "enfriamiento." We wish to specially emphasize this general observation of instinctive jibaro pathology, because, for all that they may say of improper and insufficient food, this word of explanation is almost always appended. The sharper ones accuse their annual dermatitis of being the cause of their infirmity.

We wish to observe, further, that the coffee sections and damp shady localities in general are the most anemia-plagued spots in Porto Rico, and that, in such localities, mazamorra hardly spares anyone at any rainy season; that for every one who will give a history of probable mouth infection a thousand will attest to attacks of mazamorra. We realize that many persons dislike to acknowledge the possibility of having introduced, even inadvertently, wet mud into their mouths, but many also do not care to recount an eruption of any kind, because it is considered a taint and, on the feet, an evidence of filth. We believe that of the few who stated to us that they never had a skin eruption many had had mazamorra and had forgotten it, which is unlikely, or would not confess to it, which is much more probable. In fact, among such of our patients whose station in life was far better than that of the poor jibaro and who never work with the soil mazamorra was almost always elicited in their previous

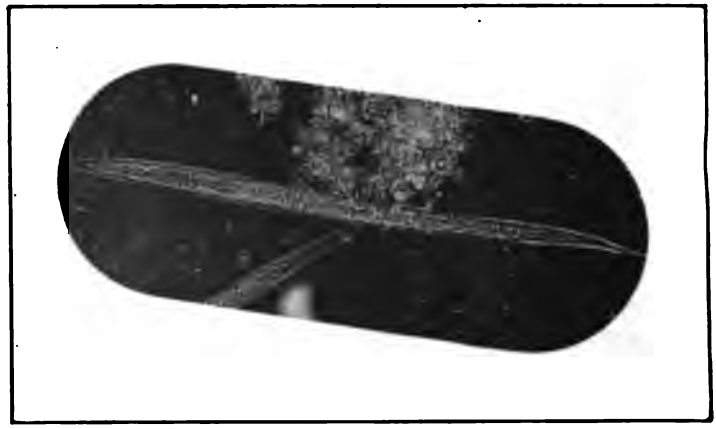
history and ascribed to the paddling about on the edges of streams incident to a country bath. In such cases, to attribute their infection to swallowing mud or muddy water would be in the face of strenuous denials by the patient that such a thing could have been possible. We have frequently had cases of chronic uncinariasis in persons who always normally wear shoes, but who date their illness back to the "exposure" incident to the cyclone of August, 1899, and its subsequent heavy rains. This means that for perhaps the first time in their lives these persons, always accustomed to live well, were exposed to the grumous mud and water following the hurricane and inundation, and thus became infected. We have no way of determining that, among the well-to-do classes, this was a common time of infection, but we are almost positive of it in some cases and have good reason to suspect it in others. What, then, shall we say of the huge army of country poor who frequently date their anemia from that period which gave, in the year following, the largest number of deaths yet known here from anemia, 12,000 and more? Here poverty and suffering joined hands with disease to bring about a calamity.

That the deepening anemia in these country people at that time could not have resulted from poverty and distress alone we know, although we have had ocular demonstration of the profound distress, general at that time. At the field hospital for the indigent poor of the Ponce district, the cases of anemia applying for admission, seen three weeks after the cyclone, were not anemics of three weeks nor of three months. We have no doubt that many were the subjects of an acute exacerbation of their chronic disease through reinfection at that time, for, in the days that followed, all the best food that could be bought was unsuccessful in reclaiming many cases. Let us turn our attention to a very few examples culled from many similar instances, and first invite special attention to cases 14, 19, 20, etc., of the 61 special cases at Utuado, and to cases 1 and 16 of the Bayamon series. A perusal of these will illustrate the point in question.

One of our most interesting cases is found in case 4,431: R. M.; 29 years of age; full-blooded negro. He was hired by us to cart the large ash cans, used for the reception of feces in the camp privies, to the ground selected for burying their contents. His duties were to dig a hole, empty the cans, rinse them with milk of lime, and replace them. He worked for 16 days, and at the end of that time reported to us for treatment, saying that although he badly needed the money he was too ill to work any longer, for he was very weak, had severe lancinating pains in his stomach, and was "eaten up" by mazamorra. He stated that the gastralgia supervened on the eighth day after his dermatitis began, and explained that his disease had risen from his feet to his stomach, and that that "hole in the ground" was responsible for the entire matter. We found that he had had mazamorra some years before, but had never before been sick. He had many ova of uncinariæ in his stools, and his hemoglobin registered 15 per cent. We conclude that his relative racial immunity was overcome by an enormous infection.

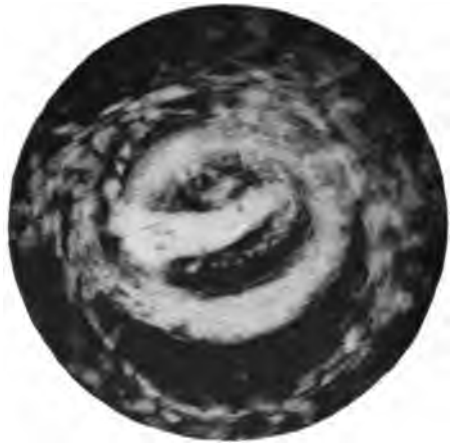
The last case to be cited is that of a soldier in the Porto Rican regiment stationed in San Juan. He was admitted to hospital with severe mazamorra which he acquired cleaning some pits near Morro Castle, barefooted. We were given permission by the surgeon, Maj. Lippitt, to study the case, and the man was sent for some of the mud

CARRYING A PATIENT FROM THE COUNTRY TO THE FIELD HOSPITAL, UTUADO, 1904.



THE LARVA OF NECATOR AMERICANUS.

By late Dr. Wm. Gray.



THE ACTIVITY OF THE LARVA OF NECATOR AMERICANUS.

By late Dr. Wm. Gray.

which he said was that from which he had contracted his dermatitis. Larvæ of uncinaria were found in abundance. Of the 947 cases at Bayamon, 284 were asked about mazamorra; 263 said that they had had it and 21 gave no history of attacks. Most of the cases at Utuado were questioned on this point. Of the 61 special cases, 1 gave a doubtful history of the affection, the rest positive. Of the 4,482 cases belonging to the general series, there were 86 who were not questioned on this point and 65 who stated that they had not had it.

Most of these who gave a history of mazamorra stated that they were victims of it "at every coffee crop," and some of them were completely incapacitated for work.

In all of 5,490 cases of uncinariasis, 749 were not questioned concerning mazamorra. Of the 4,741 who were, 4,654 stated that they had had it, a percentage of 98+

PREDISPOSING CAUSES.

There has been a long list of conditions which have been cited in the past as causes of "anemia" in the Tropics. While their influence upon the blood is not lost sight of, it is well known that they have heretofore been considered, not only in Porto Rico, but in all tropical and subtropical countries, as the determining cause of the profound anemia which is but a symptom of the disease under consideration. An entire population, not only anemic, but suffering from a series of other symptoms which form a distinct clinical picture, and which, for this reason, have led medical observers, before *Ankylostomum duodenale* was discovered, to dignify by a separate and distinct name, can hardly be considered, in these days, to be the subjects of one infirmity caused by a thousand and one etiologic factors. No one to-day would venture to prove that tuberculosis could exist without the tubercle bacillus, and yet no one denies that bad food, hardship, and an unpropitious climate work destruction in the presence of this terrible infection. The days of "miasms" have gone, yet we know that a cabin in a swamp is generally malarious because it is a breeding place for anopheles mosquitoes. It is unfortunate that such explanations are needful, but, as so many are still inclined to lay the blame for a widespread endemic on a motley collection of predisposing causes and debilitating influences, which act in uncinariasis as they do in every other disease, we think it proper to give to the prominent ones their places in a tragedy which without Uncinaria would be Hamlet without Hamlet.

Food.—The question of insufficient and improper food as a cause, and to the majority, the chief cause, of anemia on the island has previously so dwarfed all other considerations that, until recently, little thought was given to any other. The essential point is, does the protein element in the food of the Porto Rican jibaro suffice to keep him in physical well-being?

Of course, protein alone is entirely insufficient and carbohydrates and fats must be supplied. This is practically seen, as Gilman Thompson remarks in his "Food and Dietetics," by the Eskimo, who eats enormous quantities of fat with his meat to enable him to resist the cold and fatigue of long sledge journeys. He is, however, no stronger than the Central-African negro whose proteid is chiefly of vegetable origin, assisted occasionally by fish and game. Both,

however, have a proteid and carbohydrate constituent in their foods, although one derives it from animal, the other from vegetable sources. The Polynesian warrior is more ferocious on a diet of plantains than the Eskimo who eats nothing but fish, meat, and fats. The Japanese are essentially a rice-eating people with a small but potent amount of nitrogenous food. "The Mexican, whose supply of meat is scanty and of poor quality uses the native bean or frijole at almost every meal, made into a stew with vegetables and, perhaps, shreds of sun-dried beef" (M. A. Abel). The same might be said of many parts of South America.

Hutchinson says:

> But vegetable foods possess not merely abundance of carbohydrates, they contain proteids and fats as well. Some members of the class, such as the pulses, are particularly rich in the former; nuts in the latter; but of vegetable foods as a whole it may be said that they tend more than the animal foods to contain representatives of all the three groups of nutritive substances. In consideration of this fact, the vegetable kingdom must be pronounced a better source of human food supply than the animal, and, if one were confined in his selection of a dietary exclusively to one kingdom or the other, it would be wiser to patronize the miller and green grocer than the butcher and fishmonger, for it is undoubtedly possible to live on vegetable diet alone, whereas it is difficult to live for any length of time on nothing but meat. The way for most people, however, is to avail themselves of the resources of both kingdoms.

The food of the Porto Rican jibaro embraces bananas, plantains, various tubers whose food value approaches that of the potato, "gandules," of the value of the pulses, rice, and beans. He can almost always cultivate corn but knows very little of preparing it for use as a food; codfish, though cheap, is an article which must be purchased, and many of these poor people can not do so. Still, many more have it than is generally supposed. For example, in Utuado, the poorest district on the island, we noted the presence or absence of meat fibers in the first 200 specimens of feces examined. In 83 they were found. Of these 83 persons, 60 were profoundly anemic, 15 were moderately so, and 8 had slight or no anemia. It is not understood why fresh fish can not contribute to the protein element lacking in the food of the poor in Porto Rico as it does in Japan, also a thickly populated country.

While not unmindful that many believe that even vegetable food is lacking in the interior, it is believed that this is an error. Vegetable food can be secured in amount necessary to sustain life. With few exceptions it is only when a whole family is too sick from uncinariasis to work that all food becomes scarce and starvation threatens. We know of innumerable cases where half-sick jibaros are supporting invalids too ill to do more than lie in one position all day. We do not intend to write a thesis on the food value of the vegetables of the island, but we desire to call attention to several articles somewhat despised for a supposed low nutritive value.

Varieties of bananas and plantains.

	Banana flour.	Wheat flour.
	Per cent.	*Per cent.*
Moisture	13.0	13.8
Proteid	4.0	7.9
Fat	.5	1.4
Carbohydrates	80.0	76.4
Mineral matter	2.5	.5

Knight quotes M. Humboldt who states that 33 pounds of wheat and 99 pounds of potatoes require the same space as that in which 4,000 pounds of bananas are grown, and remarks on the smallness of the spots under cultivation around a cabin which contains a numerous family of Indians.

Hutchinson says:

> It is evident from this that we possess in the banana a potential source of cheap nourishment which may one day be of great importance.

Surg. Parke ("My Personal Experience in Equatorial Africa," p. 416), in an account of the Emin Pasha relief expedition refers to Mr. Stanley, who was at the time suffering from acute gastritis, as follows:

> He eats porridge made with banana flour and milk. It is very light and digestible * * * and is also very nutritious. We whites have very good reason to know this fact now, as we have mostly lived on banana flour for the past two years.

Long marches and frequent attacks of malarial fever, from which they suffered, were severe tests of the nutritive qualities of any dietary.

Banana flour can be easily prepared and is vastly superior to any other preparation of the fruit. We have had our attention called to the variability in the nutritive value of different members of the banana family, but we possess no data to prove that it would materially alter our general conclusions. We have already spoken of the high proteid value of the pulses, of which the bean and "gandul" are excellent illustrations. To mention the famous "iron ration" of the Germans in the Franco-Prussian war, is to evidence the esteem in which this vegetable proteid is held. "Erbswurst," as it is called, is a mixture of pea meal, salt, and fat, and its modifications generally form part of every military emergency ration.

Corn.—In the south of the United States this much prized food forms the staple diet of many poor people. It contains about 9 per cent fat, a component which the jibaro lacks. It is best eaten as corn meal, but here, the "hoe cake" seems not to be generalized. It contains as much proteid as wheaten flour, if not more, and should be more consumed in this island than it is, for it is a wholesome fattening food.

Alligator pears, or "aguacates," deserve special mention, as they furnish an enormous amount of fat.

Sugar in certain sections is always at hand. It is a powerful producer of energy.

Our conclusions are that the diet of the jibaro is generally poorly balanced and that many times this results in a condition of malnutrition. Between an illy-balanced dietary and actual starvation there is a great difference. One is an insufficiency of one or more of the food elements, proteids, carbohydrates, fats, or salts; the other is lack of food. Starvation came in 1899 after the hurricane and, but for the superhuman efforts of our Army, would have been more terrible than it was. Starvation may come to some who are too sick to raise crops or to work, if work be found, and to some others, from one cause or another. But starvation has one general symptom, emaciation, and such sights as we see portrayed at the time of famine in India are rare here. Before death from starvation takes place, 90 per cent of the

body fat is consumed. Moreover, nearly all authors are agreed in stating, whatever be the actual condition of the blood, that the red cell counts and hemoglobin percentages are above normal. This is emphatically not to be found here as a general thing. Hayem gives us two examples of blood counts in cases of genuine starvation which illustrate this point. One gave 12,000,000 red cells per c. mm. and 120 per cent hemoglobin, the other, 8,780,000 red cells.

The objections to a vegetable diet are:

1. *Bulk.*—In order to get the sufficient amount of proteid one has to consume 3,500 grams daily. This means that the stomach, which holds but 1,200 grams normally, has to be stuffed three times a day, often causing putrefaction of food and dilatation of the stomach and intestines with their well-known effects.

2. *Insufficient assimilation.*—Not only do the gastric and intestinal juices penetrate the food mass with difficulty, but it is an established fact that vegetable proteids are from 20 to 40 per cent less assimilable; in other words, that proportion is not utilized as food.

3. *Cellulose.*—This is an entirely indigestible material prominent as the exterior covering of most grains and pulses. Poorly cooked beans will pass through the intestinal canal entire on account of this jacket which, unless broken, locks up all nutritive material. In addition, by its mechanical irritation, food is hurried out of the canal before chance to absorb is given.

4. *Vegetable diet is not as good a source of nervous energy which should be distinguished from muscular strength as evidenced by the actual force produced in a day's work.*—Not only is it lacking in power to produce such energy, but it lowers the power of one to resist disease. This is apparent from the facility with which many vegetable-eating races fall an easy prey to epidemics.

All this may be modified by the fact that carbohydrates are the sources of force, and that the laborer of the tropics can generally get from his diet enough protein to build up his tissues if enough carbohydrate or "force food" is supplied. Herein he differs vastly from the sedentary individual who fails to perspire enough to carry off the excess of water in such a diet.

In treating of this subject, we know of no saying so wise as that of Gilman Thompson:

> There are many facts in nature, in addition to those already discussed, which indicate without doubt that man from his earliest prehistoric days has been omnivorous, adapting himself to his surroundings and eating in his primitive condition whatever his environment afforded, with least expenditure of labor to obtain it, now vegetable, now animal food. * * * A brief glance at the dietetic habits of the more primitive tribes of mankind at present living, shows no arguments can be drawn from them as to the advantages of any particular class of food.

Taking the dietetic habits of these people into account, we may conclude that they are not materially different from what they always were. By this, it is not meant that such food is not a menace to their perfect physical well-being, nor is it intended that any one shall think that we do not share the desire of everyone to see a poorly balanced diet improved. It is also known that in certain sections great poverty has supervened from depression of certain industrial interests and that the protein element in the diet of the jibaro has suffered. We also realize that a certain degree of anemia may result from extreme poverty of protein.

We therefore believe, in spite of the quotations of authorities cited (whose opinion expressed later is not different from our own on food in general), and from Thompson's remarks, that the food eaten by the jibaro in Porto Rico can not fail to produce an effect upon the prognosis of a blood-impoverishing disease.

Lest we generalize too much, let us review some clinical observations, the results of our work:

Of 947 cases treated at Bayamon, a statement concerning the nature of the food eaten was secured from 355. Of these, 225 said that they ate the usual food of the country people; i. e., rice, beans, vegetables, and codfish (now and then) and that, such as it was, they suffered no lack in quantity. Ninety who were of the better classes or their servants, stated clearly that they had a daily mixed diet. Forty said that their food was deficient in quality and quantity. Of the 225 with the usual food of the country, 217 had their hemoglobin percentages taken with the following results:

	Persons.
Below 20 per cent	14
Between 20 and 29 per cent	37
Between 30 and 39 per cent	50
Between 40 and 49 per cent	47
Between 50 and 59 per cent	30
Between 60 and 69 per cent	21
Between 70 and 79 per cent	11
Between 80 and 89 per cent	5
Between 90 and 100 per cent	2
Total	217

Average hemoglobin percentage in this class, 43+.

Of the 90 persons with a full mixed diet, 86 had hemoglobin percentages of blood taken as follows:

	Persons.
Below 20 per cent	2
Between 20 and 29 per cent	17
Between 30 and 39 per cent	21
Between 40 and 49 per cent	20
Between 50 and 59 per cent	11
Between 60 and 69 per cent	8
Between 70 and 79 per cent	5
Between 80 and 89 per cent	1
Between 90 and 100 per cent	1
Total	86

Average hemoglobin percentage in this class, 43.5. The remark "best class of food" is found in two cases, one with 93 per cent Hb. and the other with 24 per cent.

All the 40 persons on a diet, which they said was purely vegetable, and restricted at that, gave hemoglobin percentages as follows:

	Persons.
Below 20 per cent	1
Between 20 and 29 per cent	10
Between 30 and 39 per cent	7
Between 40 and 49 per cent	8
Between 50 and 59 per cent	5
Between 60 and 69 per cent	3
Between 70 and 79 per cent	4
Between 80 and 90 per cent	2
Total	40

Average hemoglobin percentage in this class, 44+.

We find the following remarks in our notes on these 40 cases: "In two Toa Alta cases who ate the poorest of poor food, one had 95 per cent Hb., the other 28 per cent." The first had extremely few ova of uncinariæ, the second many. We have repeatedly noted instances where one with severe anemia was accompanied to clinic by markedly rosy and healthy individuals of the same family who ate exactly the same food. In some of these families the poorest kind of food was eaten; in others the best, depending on their station in life. Generally, the healthy looking ones had little or no infection; the pallid were always heavily infected.

For notable illustrations of how little food may influence the "anemia" of the island, see Case 2 in Utuado series, where expulsion of uncinariæ was followed by a rise in Hb. from 38 to 100 per cent in about six weeks, although the man never received a bite to eat at the hospital at any time, and was continually complaining of poor food at home. Case 7, same series, left the hospital after requiring six weeks to rise from 10 to 64 per cent Hb. In two weeks more he rose from 64 to 103 per cent Hb., living at home and eating what his father described as the poorest of food. Cases 8, 11, 15, and 47 are similar. Case 19 shows severe anemia developing, once in Ponce with good food, and once in Utuado with poor food. Cases 20 and 58 of the Utuado series, and Cases 1, and especially 16, of the Bayamon series, illustrate how the best of food does not prevent anemia of uncinariasis.

Climate.—As a cause of marked anemia, per se, there is no reasonable ground for fear in Porto Rico on account of climate. We will not attempt to defend what on its very face is evident: that, with a bright, sunshiny little island out in the Atlantic, fanned constantly by breezes, with a mean monthly temperature of 75° in January to 82° in August, and a mean annual temperature of 72° in the mountains, excessive heat can not be cited as a cause of anemia. If diseases run riot, the hand of man has sown them, and, until measures are taken to prevent it, he will continue to sow them and reap the fruit of his own negligence; for the climate of Porto Rico is propitious, not only for the perfect development of human kind, but for that of the manifold varieties of parasitic life. In this sense, climate is a factor in the epidemic under consideration, in that it affords to the parasite a proper temperature for its development in the open air. So does it provide a home for *Stegomyia fasciata*, "the yellow fever mosquito," but efficient quarantine has prevented its infection.

Humidity and rainfall.—The average humidity is 80 per cent, which is, of course, high. The annual rainfall varies considerably. In San Juan it is 60 inches, but in the northeast corner of the island it is 100 inches and over. Thus Porto Rico has an abundance of rain. It is rare, however, that the sun does not shine the major part of the day. Seasons of drought do occur, especially in certain parts of the island, but Porto Rico is noted for its heavy green mantle and rich, fertile soil. There is a rather indefinite division made of a wet season and a dry season, the former corresponding to the time of harvesting the coffee crop. This is known everywhere as the sickly season, as will be noted by the inspection of annual mortality tables here.

The mud formed is slippery, grumous, and pervades everything, and it is no wonder that at this time of the year the mortality rises,

for here again is added another of the necessary elements in the development of the uncinaria ovum.

We realize that humidity is the general condition which aids in bringing about many diseases, but the fear of a damp locality in Porto Rico is all out of proportion to that felt in other regions. Towns are popularly divided into "damp towns" and "dry towns." Although the temperature is lower, the wet season is the deadly season, chiefly because it is the hatching time par excellence of uncinaria ova. We do not mean that in the dry season, often visited by rains, development does not also occur, for Porto Rico is seamed at short intervals by brooks, streams, and rivers which furnish abundant moisture. There is one more source of humidity in the island—the heavy dews, which, falling in shady spots, keep them damp all day in spite of the sun.

Uncinariasis is a disease of the poor, and the poorer the man the more exposed is he to heavy infection. Here again poverty alone is considered a cause of "anemia," whereas it is really a predisposing element. It is unnecessary to mention more than a few of the occupations which bring people into conditions which favor infection.

1. *Coffee culture.*—Coffee pickers and laborers on coffee estates are the most exposed of all laborers in the island. They are doubly exposed in that the environment of their dwellings is loaded with uncinaria larvæ and that a similar condition exists at their place of work. This is, to the barefooted man, the most dangerous pursuit in Porto Rico, and this danger is enhanced by the fact that the most of their work is done at the very time when conditions are most propitious for infection. So true is this that practically all of our Utuado cases stated that at the time of coffee harvesting their feet were literally "eaten up with mazamorra."

2. *Sugar plantations.*—Infection in sugar plantations is not so common at the place of work, but nevertheless is frequent, especially in the irrigating ditches.

3. *Washing* on the edges of streams sometimes produce mazamorra. Such spots are often heavily infected.

4. *Banana groves.*—A most intense infection may be acquired in such localities.

Habits.—Uncinariasis is preeminently a filth disease. The only means of infesting the soil is by evacuation of the bowels where the ova in the feces will later develop. If sanitary privies were generally used, uncinariasis would forever disappear. This is the key to the whole situation, as outside the human body the larvæ never pass beyond the encysted stage. Even the last census report gives no conception of the absolute disregard for sanitation in this respect in the country districts. Practically all of our Utuado cases stated that they deposited their feces in the open country and had no privy nor even a hole in the ground for this purpose. Our special cases there are fair examples of the average—of 61 persons 55 had no privies and 6 generally used them, but only two of the latter lived in the country, the rest in the town. In Bayamon a much larger percentage of our patients were more comfortably situated in life—342 were questioned on this particular, and 53 stated that they used privies; the rest, 289, never used one. Thus the average individual living in the country, barefooted and devoted to agricultural pursuits, from time to time acquires more and more uncinariæ from infections sown

by himself and his neighbors. This is a constant inflow. The time naturally comes when the parasites in his intestines die of old age or of some accident which cuts off their existence, and, as Boycott and Haldane remark, the dead larvæ are at least partially digested by the intestinal juices. Thus they are passed out of the canal with no mark by which they can be recognized.

This is one of the reasons why, when a jibaro comes to town where infection is not possible, or at least rare, he often gradually gets better of his anemia, i. e., his multiple reinfections are cut off and the parasites he brings with him die as they reach the limit of their natural existence. Such improvement is often explained here by the statement that "the most anemic jibaro, on reaching San Juan and finding proper food and lodging, immediately begins to improve." The fact of improvement is often seen, but not immediately. The reason for improvement is not correctly expounded. This is the so-called "natural cure."

A study of the following data, obtained from a systematic examination of the inmates of the Girls Christian Orphanage is illustrative of this point. These girls reached the school in all grades of anemia, undoubtedly due to uncinariasis. The superintendent stated that 31 of them were pale, some extremely so, and that after a few months their general condition began to improve, until at the end of two or three years "all anemia" had disappeared. Four were in the institution less than two years, 5 between two and three years, 35 over three years, and 1 a period unknown to us. As will be seen from the table, their average hemoglobin now is 82+ per cent, the average of those without ova in the stools being 82.8+ per cent, and with ova 82 per cent. A few of them are still pale. Thirty-eight of them have ova in their feces, and 7 have none. There was considerable difficulty in finding ova in the majority, and some had to offer a second specimen before they could be found. In general, therefore, few were encountered. They are all well shod, neat, tidy girls, and the chance of reinfection is small as good latrines are provided.

A noteworthy bit of information is obtained from the column headed "geophagy," where 16 are found to be "earth eaters." It would seem as though this was an almost certain mode of infection, but the "earth" eaten was almost always plaster or similar incongruous material, not wet earth. Sixteen of the 45 had this habit, which throws a flood of light on the habits of the jibaro, practices which he will never acknowledge and which are only known by just such accurate data as this obtained from observing teachers.

Let us assume that practically all were infected on admission:

1. Many uncinaria gradually died off and none took their place, or, if any, very few.

2. Under good care and hygiene an individual relative immunity was established to those that remained.

Aside from the nonuse of latrines, the various local habits, some not peculiarly affecting the disease, others offering other means of infection, need not be detailed. For example, the abuse of alcohol can hardly affect uncinariasis and its attendant anemia more than it affects other diseases; the general habit of going barefooted is a real source of danger and a means of direct infection, etc. The playing of children in muddy places should not be lost sight of.

Some curious infections occur: One prominent American, a man of most scrupulous personal habits and one in whom infection by the mouth seems impossible, contracted slight mazamorra by taking off his boots and wading in a small pool. Several months afterwards ova of uncinaria were found in his stools. He informed us that another American, similarly affected, was sent home very ill with anemia, and that he is supposed to have malaria cachexia. The picture drawn of his symptoms makes it more than probable that he is at least suffering from uncinariasis, whatever else he may have.

In broad general terms, it may be stated that the conditions found in cities and large towns of the island do not conduce to so heavy an infection as in the country and that many pallid individuals seen on the streets of San Juan have been infected in the interior. The unsanitary habits of the laboring classes in some towns and hamlets render it likely that infection does take place in certain of the worst sections, given shade and moisture.

Age.—The ages of all our patients, arranged in groups of five years, is as follows:

Age.	Bayamon.	Utuado.	Special cases.	Total.
Under 5	11	24	0	35
Between:				
5 and 9	99	427	5	531
10 and 14	122	887	18	1,027
15 and 19	114	636	9	759
20 and 24	131	501	9	641
25 and 29	142	564	5	711
30 and 34	67	424	6	497
35 and 39	72	326	7	405
40 and 44	44	219	1	264
45 and 49	43	145	1	189
50 and 54	31	164	0	195
55 and 59	30	65	0	95
60 and 64	7	61	0	68
65 and 69	13	17	0	30
70 and 74	2	8	0	10
75 and 79	2	5	0	7
80 and 84	0	3	0	3
85 and 89	0	1	0	1
Age not given	17	5	0	22
Total	947	4.482	61	5,490

Thus the first decade furnished 566; the second, 1,786; the third, 1,352; the fourth, 902; the fifth, 453; the sixth, 290; the seventh, 98; the eighth, 17; the ninth, 4.

92+per cent were below 50 years of age and 62+per cent of these were between 10 and 30.

In interpreting these figures, we desire to call attention to a sentence in a previous report on this disease in the island (A Study of Uncinariasis in Porto Rico, Am. Med., Vol. 6, Nos. 10 and 11):

> It is a startling fact that while Porto Rico has a larger proportion of children to adults than any other State except South Carolina, yet in 1890 the percentage of persons over 60 was but 40 per 1,000, compared with 62 per 1,000 in the United States.

We believe, that apart from this, the disease is most destructive in the young, not only of life, but that it is between 10 and 30 that the great amount of sickness occurs, as seen from the table. A relative immunity may, and probably does, come to those who have suffered

the consequences of infection and who have survived its baneful effects. Persons of all ages are liable to become infected, given exposure to the parasite.

Sex.—Of 5,490 patients, 3,259 were males and 2,231 were females or 40.6+per cent. This is largely due to chances offered for infection, males naturally being more exposed from the nature of their occupation. Not only is this so, but the degree of anemia is less in females than in males, obeying to a certain extent, at least, the number of parasites with which each sex is infected. In Bayamon, of 577 persons in which the hemoglobin percentage was estimated, excluding the Girls Christian Orphanage cases, 165 females gave an average of 48+ per cent Hb. and 412 males, 41+ per cent.

Sex compared with hemoglobin.	Females.	Males.
Between:		
10 and 19 per cent hemoglobin	7	24
20 and 29 per cent hemoglobin	26	86
30 and 39 per cent hemoglobin	30	97
40 and 49 per cent hemoglobin	21	97
50 and 59 per cent hemoglobin	29	43
60 and 69 per cent hemoglobin	24	34
70 and 79 per cent hemoglobin	20	17
80 and 89 per cent hemoglobin	6	9
90 and 99 per cent hemoglobin	1	5
Over 100 per cent hemoglobin	1	0
Total	165	412

Only three of Sandwith's 400 cases were females, due, he says, to the oriental custom of immuring women.

Race and immunity.—It seems difficult to separate the two, so we have proceeded to discuss them together.

Sixty per cent of the population of the island is said to be white. The negro race possesses a higher degree of immunity than the white, but this is not absolute in the Americas. Jacoby and Zinn state their belief in the immunity of the negro. The dangerous nature of the parasite was first practically demonstrated in Egypt, and has since been fully proven there. Literature on uncinariasis is not complete without reference to the terrible ravages of this disease in that country, yet the aboriginal tribes of the Congo, and, indeed, all through Africa, are infected but show no signs of disease. Here, in one continent, we have a sharp contrast between the negro and the white race.

We are fortunate in having direct information of the section least explored. Mr. T. Stevenson, a missionary for some years in Central Africa, was living in Utuado during our stay there. He had had occasion to use medicine in his work in Africa, and was attracted to our camp. He told us that the food of the tribes where he served is almost exclusively vegetable; that they are men of gigantic stature and perfect physical development, yet were subject to a severe dermatitis of the feet in wet weather, which they ascribed to poison laid on the ground by their enemies. He states that the resulting ulcers were very severe at times, but that he had not noticed the disease in Africa, although the dermatitis was familiar to him. As to racial differences in the grade of anemia, we are able to compare 540 persons in whom race and hemoglobin were noted.

Race compared with Hb.	Whites.	Mulattoes.	Negroes.
Below 20 per cent Hb	20	8	1
Between:			
20 and 29 per cent Hb	83	23	1
30 and 39 per cent Hb	88	31	4
40 and 49 per cent Hb	82	26	9
50 and 59 per cent Hb	43	26	2
60 and 69 per cent Hb	39	16	2
70 and 79 per cent Hb	10	11	2
80 and 89 per cent Hb	6	5	1
90 and 99 per cent Hb	.....	.....	.....
100 and 110 per cent Hb	.....	.....	1
Total	371	146	23

This gives an average of 45+per cent Hb. for the white race, 44+ per cent for the mulatto, and 49+per cent for the negro. A much more important observation was that very few negroes sought our clinic. The people who did, came not because they were pale, but because they were ill, and had the negro felt ill he would have come just as readily as the mulatto. Now, Bayamon, from which came these 540 cases, is a municipality in which many negroes live. We must conclude that immunity to the toxin exists in them, at least to a certain extent. In other words, absence of several generations from its haunts reduces the immunity of the negro race.

That it is not absolute is seen by case 4,431, cited before, and we conclude that in this country racial immunity is no longer a protection from an unusually large infection. Leichtenstern, in 1899, stated that the old races of Asia are relatively immune to the toxin, but are worm carriers. Such are notably the Hindus, where Dobson shows an infection of 75.58 per cent of "healthy" coolies. That even there there is no absolute immunity is amply attested by the storm over this assertion, in which Thornhill and Giles proved its death-dealing qualities in that same country. But not only this, Thornhill adds that, in Ceylon, uncinariasis is more fatal than cholera, and McDonald, in that island, reports 1,760 cases treated in hospital, with 395 deaths from the disease. One of the writers had a case of a soldier with uncinariasis who was infected in the Philippines, and who said that about 20 men in the company had the same symptoms, causing them to fall out on the march. He further added that the natives are very healthy.

Thus negroes, and possibly Malays and Mongolians, are relatively immune to the disease while harboring the parasite, remembering that we have no knowledge of the number of worms these people usually carry, an important point. There is nothing at all strange in this, as it is well known that relative immunity exists in yellow fever, especially in negroes. No one to-day denies that individuals exist in whose blood the plasmodium of malaria can be found, but who show no symptoms of malaria, nor that the famous French physician, who found that 60 per cent of the many cadavers he autopsied presented lesions caused by the tubercle bacillus, was correct in his statement that a relative immunity holds the bacillus in abeyance until a long life is run, the individual dying of other causes.

This brings us to the question of individual resistance to the toxin.

Literature and the personal experience of many here attest the frequency of infection by uncinaria without objective symptoms of

disease. Many of them have no anemia, yet are clearly suffering from other manifestations of uncinariasis. Frequently our light cases in Utuado had little anemia, yet were far from well, seeking our camp on that account, and while some were lightly others were heavily infected.

Individual resistance to the disease is natural, inherited, or acquired. In all these, one prominent factor is ever present. We refer to the conditions of life under which a person lives. As we send a case of incipient tuberculosis to parts where climatic and other influences build up the resistance; as we feed up a convalescent, with the intention of supplying to the body a force which will better enable him to cope with disease, so it is perfectly clear that good food in uncinariasis is not only an aid to recovery, but an aid to the body in fighting a poison, and to good food might be added a host of other factors. We have cited, however, an instance (case 16, Bayamon series, p. 148), where all that care and money could bestow resulted in a complete failure until specific treatment removed the cause of his infirmity. Yet it is a valuable weapon to turn against uncinaria when we are able to command a good pantry and a good bed for our sick. Thus were our desperately ill cases tided over a critical period in Bayamon and Utuado, and for this reason hospitals are needed.

Boycott and Haldane say with regard to infection in the mines of Cornwall:

> Fresh infections must, however, be occurring and the facts are most easily explained on the theory that in the majority of individuals some form of immunity is gradually established to the presence of the worms. Nearly all the men working in the mines appear to be infected. A great many of these suffered at first from anemia, but gradually recovered completely without giving up their employment and without treatment. On the other hand, there are some individuals who continued to be ill for long periods even after giving up work underground and in whom therefore the immunity did not become established, though they recovered when treated with thymol.

We are immediately impelled to cite the fact that after a sharp attack of diphtheria has been overcome the bacilli remain, propagate, and excrete their poisons in an otherwise perfectly healthy throat.

We are not, however, in accord with Boycott and Haldane that this is all a question of acquired immunity. From their descriptions we are inclined to believe that they were not dealing with such heavy reinfections as we have here.

All of the data concerning predisposing causes is insignificant as compared with the following facts elicited from a study of the disease.

Of 4,482 persons treated in Utuado (excluding our special cases), not more than 300 of whom were ever rationed even for a short time by the commission, living in their homes as they had always lived, extremely poor, and generally with an illy balanced, often an insufficient, dietary, 2,151 were radically cured, expelling their uncinariæ and leaving the clinic with normal blood, tested by instruments; 273 were practically cured; and 1,495 were improved. We may now understand why Stengel writes of secondary anemia as follows:

> The effect of diet is difficult to determine, as the experimental evidence and some of the investigations made upon persons undergoing prolonged fasts have been quite at variance in their results. Senator and Luciani found that the blood of the Italian fasters, Cetti and Lucci, did not undergo the deterioration

that might be expected, and experiments on animals have sometimes shown considerable increase in the number of corpuscles instead of decrease. When the blood is decidedly affected, this is probably due to secondary or associated conditions, such as fever, organic disturbances, etc. Continuous bad food, however, is usually associated with other debilitating influences and undoubtedly leads to anemia, as is seen by the inhabitants of besieged cities or in times of famine. * * * Residents of tropical climates frequently present a strikingly anemic appearance, particularly when they have recently arrived in such climates, but to a large extent this appearance is deceptive, being probably due to vaso-motor conditions rather than to a condition of the blood itself. *The actual anæmias of the tropics are dependent upon definite and specific causes.* (Alfred Stengel, M. D., "Twentieth Century Practice of Medicine," v. 7., pp. 312–313, Wm. Wood & Co.)

The italics are ours.

After reviewing all the evidence, we find it clear that heavy infections generally produce the disease in practically all save those who are racially immune, and often in them; that slight infections often do and, according to the facts of immunity, may not; that moderate infections oftener do produce the disease in the people of Porto Rico than not; that every circumstance which tends to devitalize a human organism will decrease this immunity and give fuller play to a dangerous and, many times, fatal toxin.

Hence to trust alone to building up the resistance of the Porto Rican jibaro and not to treating him for his disease would be as ridiculous and costly as to order a fire brigade to turn its entire attention to soaking with water houses a block away in the hope that this would prevent a general conflagration, leaving the fire to burn at its own sweet will. From a clear knowledge of these truths, Germany is attacking a disease for the possibilities it represents. This is all the greater tribute to their grand foresight and sane judgment, when we realize that but 6.8 per cent of the infected workmen present signs of anemia. For the same reason the United States and Europe are beginning to view uncinariasis with alarm and to seek to stamp it out before a general sacrifice of health, happiness, and human life is made.

Porto Rico has taken the initiative in the Tropics in inquiring into the cause of the profound anemia of her laboring classes and in testing feasible means of treatment and prophylaxis. We have seen that the major portion of this "anemia" is uncinariasis and we earnestly recommend to our professional brethren, some of whom need no such recommendation, that no further reliance be placed on iron, quinine, and tonics in general, which after a trial of years have proved themselves utterly incapable of controlling a disease which is every day threatening more and more the existence of the unfortunate jibaro.

PATHOLOGY.

[In the original report both pathogenesis and morbid anatomy were combined, but as it is unnecessary to rehearse this entire chapter, the gist of which is covered in a more acceptable manner elsewhere, we will merely cite the part devoted to the pathogenesis.]

PATHOGENESIS.

The worm has always been considered a bloodsucker, sustaining itself by assimilation of the plasma, not the corpuscles. It is found

with its head buried in the mucous membrane and the buccal capsule so well fastened to the intestinal wall as to require some force to dislodge it. Many writers have declared the amount of blood thus lost to be utterly insufficient to produce anemia of such grade, a belief with which we have been in accord. Loeb and Smith (Proc. Path. Soc. Phila., June, 1904) state that the worm excretes a substance at the point of its attachment to the intestine, which prevents coagulation of the blood, as do leeches, and that on changing their feeding ground they leave a wound which bleeds for some time. Calculating the loss of blood occasioned by each worm to be one drop daily, 500 would cause a loss of 20 grams. There are, however, some facts which throw doubt on hemorrhage as a cause of the anemia: (1) Blood in the stools is not a common symptom in our experience. (2) The worms are rarely seen to contain blood in many examinations we have made. (3) In some individuals a few worms, too few to cause an appreciable loss of blood, will keep up a severe anemia which is cured by their expulsion.

Leichtenstern believes that the male is not a bloodsucker, and also states that a general change of feeding ground is apt to occur every three to six months. During pairing time colicky pain and all digestive symptoms are prominent, and blood sometimes appears in the stools, but in the intervals neither one nor the other is marked.

Our own observations lead us to consider the latter discussions of little moment here. The worm undoubtedly changes feeding ground, but as the infected in Porto Rico are constantly receiving fresh infections, they can not well be free from pairing of their uncinariæ at any stated time. Pains in the epigastrium are common in all stages of the disease here, perhaps due to frequent reinfections. The late observations of Looss are of the greatest interest. He states that all authors until now, save Sangalli, have agreed that the nematode is a bloodsucker. The latter believed that the uncinaria feeds on the intestinal mucosa, a view which Looss declares is correct, and adds that if blood is found in the intestinal canal of the worm, it means that by accident it has opened up some vessel which, if small, causes slight and imperceptible bleeding; if large, hemorrhage, which will be perceptible in the stools.

Considering loss of blood by hemorrhage a partial source of anemia, let us turn to what is undoubtedly the chief cause of this and, perhaps, many other pathologic conditions found during life and at autopsy—the toxin. The reasons for our belief in a specific poison are:

1. There is a remarkable eosinophilia in this disease, to be discussed later.

2. There are nervous symptoms, out of all proportion to the anemia actually present.

3. There is a rapid improvement in the mental condition of the patient while yet the treatment has failed to affect the other symptoms, especially the anemia.

4. There is a relative immunity to the disease enjoyed by some who harbor the parasites. All equally infected should lose a like amount of blood, and, if hemorrhage alone were the cause of anemia, we would not see such disparity in the reaction to the infection as daily experience demonstrates.

5. By some cases of anemia in human beings supervening on infection when time was not given for the ultimate ecdysis and formation of a suctorial apparatus (special case 19 and others).

6. The repeated observation that red cells may be normal, or nearly so, with a very low hemoglobin, and this at the onset of the disease.

7. Retinal conditions frequently found in the eye in uncinariasis.

The third great cause of anemia is the mechanical wounding of the intestine, setting up chronic inflammation and perhaps affording entrance to micro-organisms. As the disease progresses, overstuffing of the stomach, chronic disease of vital organs like the liver and heart, and a host of concomitant causes aid in protracting and aggravating the deterioration of the blood.

Course, Prognosis, and Lethality.

In cases where a moderately heavy infection takes place, and the patient is young, resistant, and has the benefit of wholesome food and good care, a certain degree of anemia results, which, as a rule, gradually wears off as time goes by, provided that no new infections are engrafted upon the first. Such cases are rare here, for in Porto Rico the country people, who form the mass of anemics, are very poor. They are limited to the confines of a narrow valley, a coffee plantation on a mountain side, or a sugar field. They are constantly open to reinfection and lead a life of chronic invalidism. In their half sick condition they become dispirited, indolent, and thoughtless of the future. Before long food gets scarce for lack of strength to procure or produce it. The family is large, and the man, the breadwinner, falls ill. He becomes edematous and dies, leaving his wife and children to work out their own precarious salvation. Many times this varies; the children go first, or the wife dies of the disease itself or of childbirth, its dangerous complication.

They live far from town and to reach them the municipal physician has to risk life and limb over rocks, mud, steep mountain trails, and swollen streams. Many times they are never reached in time of illness, and the disease has become such a curse that it is known by the jibaro as "la muerte natural" (the natural death).

It has been said that but a small per cent of the deaths recorded as due to "anemia" are really due to any such thing. We are emphatically of another opinion. The jibaro knows his disease better than his educated countrymen who rarely have it. He dies of "hinchazón" (general edema), is "descolorío" (pallid), and the picture he draws is so faithful that we have come to rely upon it. Such deaths are recorded as "anemia" by the "comisario," the chief of the barrio, and are so entered in the register. Apart from this, how many are able to trace deaths from cerebral edema, generally reported as "perniciosas" (pernicious malarial fever), or the final diarrhea or dysentery, etc., often the closing scene in uncinariasis? It would be startling to one not familiar with the disease here to listen to the story of destruction that "anemia" has made in the families of these unfortunate people. No one denies that it is the most fatal affection in Porto Rico. In the United States and Europe the number of deaths from uncinariasis is exceedingly small, but here the mortality is something terrible. Our own estimate of it is that it

causes about 30 per cent of all deaths, and the superior board of health has recorded from 20 to 30 per cent in times past. Many authors who have only the morbidity resulting from infection to deal with would be shocked to see to what extent its lethality may come. We see by published reports from both continents that what we have regarded here as light infections have been considered heavy there. The essential feature is the number of worms contained in an individual more than all other modifying factors put together. For this reason it is natural that one should not be surprised that there are but few cases beyond hope of cure, even in the absence of the comforts of life.

A return to health is liable, however, to be followed by reinfection and a subsequent descent to the same condition. We realize that some immunity is conferred by one attack, but this is powerless before the tremendous infections these people incur. This has already occurred in some of our cured cases in Bayamon and will continue to occur. So, until a determined effort to educate, direct, coax, or compel the use of some form of sanitary privy, and a general intelligent crusade is begun, in which the infected are treated, uncinariasis, or "anemia," is it is popularly known, will continue to reduce the white and mixed inhabitants forming the country class of the island to a lower and lower grade mentally, morally, and physically, until the very existence of the class will be threatened.

We have purposely detailed our views and the facts on predisposing causes in order to show how it is that the majority are lulling themselves into a fatal security in citing "causes" which are not such and which merely aggravate the disease.

In order to get better food people have to work for it, and these people are not usually capable of such labor in their present condition. So much for the general course of the disease in Porto Rico, which is seen to result in an increasing enfeeblement of the laboring classes.

In considering the course of typical individual cases, we refer to symptomatology and our recorded cases in the appendix. It is a gradually deepening toxemia, until the last stages arrive in which the patient, unable to get about from debility, edema, etc., lies down in his hammock or wherever he may be, exhausted, swollen, with a dilated and failing heart, and succumbs. Such cases were brought to the hospital in hammocks swung on a pole carried by two men, and a "hammock case" became a synonym for a patient in the very grave stages of the disease.

In such cases anasarca was usually manifest and extreme, often with edema of the lungs, enormous ascites, dilated heart, and pericardial and cerebral effusions.

Obstinate diarrhea frequently marks a fatal termination. Sometimes the heart symptoms, with emaciation and diarrhea, are the prominent features, and such cases are of bad prognosis. The patient as a rule dies of pure exhaustion.

On the other hand, the subject's surroundings, his resistance to the toxin, and his relatively moderate degree of infection may prevent him from any further inconvenience than the effects of a moderate anemia, indigestion, and certain nervous symptoms, with periods of improvement and of advance of the disease. He may thus lead a life of semihealth, working a few days and resting a week.

The prognosis is dependent, at least to a considerable extent, on the presence or absence of eosinophilia, as discussed elsewhere. Especially dangerous is pregnancy, and abortion, premature labor, and miscarriages are many times observed. Childbirth is often the cause of death of anemic women, although not so frequently as might be supposed, and if stillbirth does not result, the offspring is apt to be poorly developed and liable to marasmus. Barring intercurrent diseases, the prognosis is good in the light, moderate, and even severe grades of the disease, provided no additional infections occur, but in the extreme grades, even under treatment, the outcome is dubious.

INTERCURRENT DISEASES.

Only the more common ones will be mentioned in detail. A list of such others as came under our notice in our clinic will be given with the number of times observed.

MALARIAL FEVER.

This is a serious complication and, when it occurs, the combination is apt to be fatal if continued any length of time. Case 6 (Utuado series, appendix) was an instance of the intercurrence of this disease. Here in Porto Rico, tertian benign fever is the usual form encountered, but we have found several cases with the typical ring forms, crescents, etc., of the estivo-autumnal variety. In Ponce one of our cases, nearly cured of uncinariasis, was suddenly seized with pernicious malarial fever, which was rapidly fatal. Other physicians here cite pernicious forms, especially in Ponce. While malaria is not rare, it is not as common as in many tropical sections not considered to be especially malarious. We have seen two cases of "ague cake" previous to our present investigation, but of the entire number since that time (5,500), only 16 cases of malaria have been observed, some of these due to the estivo-autumnal variety. It seems to be comparatively infrequent in the mountains, where anemia is most seen.

It may be of interest to note the results of treatment by thymol of five cases of uncinariasis complicated by malaria, in which the hemoglobin was estimated before and after the administration of the drug:

(1) Hb. 30 per cent March 8; 55 per cent April 25.
(2) Hb. 74 per cent March 9; 84 per cent April 27.
(3) Hb. 42 per cent March 16; 46 per cent April 27.
(4) Hb. 32 per cent March 21; 70 per cent April 28.
(5) Hb. 47 per cent March 14; 80 per cent April 24.

SYPHILIS.

Syphilis is a relatively rare disease among the people of the mountains, and care should be taken not to confound ulcers resulting from mazamorra with a tertiary lesion.

TUBERCULOSIS.

While this is found to be the scourge of the towns and hamlets, it is very fortunately not so frequent among the country class. If one in a family acquires it, the whole family is apt to become in-

fected. We noted 20 cases in all, but the incipient form might have escaped us. Uncinariasis creates a strong predisposition to the disease, and to sow it on such soil is to insure a rapid and fatal termination. In spite of the few cases seen, this disease was our greatest enemy in treatment, as will be seen from the deaths chronicled in the appendix.

ANIMAL PARASITES.

The following list embraces all animal parasites encountered in our cases at Utuado. The majority were determined from the characteristic ova in the feces, but the number of persons so infected under each species is low compared with the actual facts. Especially is this true of *Ascaris lumbricoides* and *Schistosoma mansoni*, the first not having been always noted, the second frequently not sought for, as when a sufficient estimate of the number of ova of uncinaria was made, search was concluded. They are believed to be a far more common cause of disease in Porto Rico than the figures indicate. Bilharziosis recti is particularly common and is frequently unaccompanied by blood in the feces. There is often, however, a large amount of mucus seen in the stools. In many cases known to be heavily infected with *Schistosoma mansoni*, there are periods in which no ova can be found, and on account of this fact, amply demonstrated in several of our cases of bilharziosis, we conclude that we have passed over many such in our daily clinic. In one of the cases (case 42, appendix), *Fasciola hepaticum* was unsuspected, but one adult parasite was found at post-mortem by Dr. Gonzalez Martinez. Special cases are not included.

Parasite.	In combination with uncinaria alone.	In combination with uncinaria and other parasites.	Total.
Ascaris lumbricoides	1,199	209	1,408
Tricocephalus dispar	155	171	326
Strongyloides intestinalis	25	11	36
Balantidium coli	8	6	14
Bilharzia hematobium (Schistosoma mansoni)	16	5	21
Oxyuris vermicularis	1	2	3
Diplogonoporus grandis [1]	1	0	1
Ascaris canis	0	1	1
Ameba coli	1	2	3
Fasciola hepaticum	2	0	2
Tyroglyphus longior	2	0	2
Tenia saginata	3	0	3
Tenia solium	1	0	2

[1] Probably an error.

The following numbers of cases of various intercurrent affections were seen:

Pellagra	1	Filariasis	8
Pneumonia	1	Conjunctivitis	1
Laryngitis	1	Hemiplegia	1
Paresis	1	Renal calculus	1
Varicella	1	Scabies	2
Elephantiasis	2	Ulcer stomach	1
Jaundice	4	Marked trachoma	2
Tonsillitis	1		

In one case of jaundice the stools contained ova of *Fasciola hepaticum* and the urine was chylous, the latter probably due to a concomitant filariasis.

DIAGNOSIS.

This should usually rest upon the careful microscopic examination of the feces. There was a time in our work in Utuado when for about six weeks the three of us (later four) made from 300 to 600 of these examinations a day. This is excessive and beyond endurance if continued for any considerable length of time, especially when other duties are imposed.

	Number of persons.	Number of times.
Examined once	339	339
Examined twice	668	1,336
Examined three times	1,011	3,033
Examined four times	862	3,448
Examined five times	837	4,185
Examined six times	392	2,352
Examined seven times	201	1,407
Examined eight times	110	880
Examined nine times	44	396
Examined ten times	13	130
Examined eleven times	3	33
Examined twelve times	1	12
Examined thirteen times	1	13
	4,482	17,564

To these should be added about 4,500 examinations more for our special cases and our cases in Bayamon, a total of over 22,000.

THE OVA.

These are characteristic, and the only thing liable to be confounded with them are the ova of *ascaris lumbricoides*, stripped of their heavy bile-stained outer shell, but these latter have double contour and contain a shapeless mass of granular matter, not differentiated into clear segments. The ova of *Necator americanus* are "ellipsoid, 64 to 76 microns long by 36 to 40 microns broad, in some cases partially segmented in utero, in other (rare) cases containing a fully developed embryo when deposited." (Stiles.)

The ova of *ankylostomum duodenale* are "ellipsoid, 52 to 60 microns by 32 microns, laid in segmentation" (Stiles). In one case in Bayamon an ovum was encountered, in every respect typical of *Necator americanus*, except that it was double the size, with segments proportionately large. The two varieties are practically the same in appearance, excepting size. They are clear and chitinous-shelled, with grayish, finely granular vitellum balls, generally from four to eight in number. If segmentation has progressed further, the specimen is apt to be old. In such cases, the embryo, moving about in the shell, has often been observed but this is a change which usually occurs outside the human host, as we know of no instance where the ovum has hatched in the intestinal canal. When free embryos are seen, they are generally those of *strongyloides intestinalis*. For a more exact differentiation of the ovum some work on zoology should

be consulted. Suffice to say, that ova of uncinaria are not generally bile-stained but clear, whereas those of the commonly associated intestinal parasites are of a yellow to a deep amber or brown color.

TECHNIC OF MICROSCOPIC EXAMINATIONS.

A bit of feces the size of a match head is removed with a toothpick and placed on a glass slide. Upon this is placed a thick cover glass and compressed so as to give a clear center to the specimen. In manipulating the cover glass, rubber fingercots are desirable in case of accident. The addition of water is to be deprecated and should be used only when absolutely needful to secure a spread, as it obscures the field by a fine precipitate, and delays results. This specimen is best examined under a one-third or two-thirds objective, and a No. 4 ocular. Some prefer the one-sixth, but here again valuable time is lost and the field is not so clear nor so large. Too much light must not be employed as the delicate ovum will be passed over. The thinner parts of the spread should be first examined. Generally here in Porto Rico, from one to two minutes sufficed for the entire proceeding at the first examination, but in cases where more than one specimen must be prepared, the use of the mechanical stage is invaluable. When this procedure gives negative results in a suspicious case, the feces should be sedimented, when a still greater surety may be secured. We have used the centrifuge with good results.

Finally, failing in all else, the patient should be given a dose of the anthelmintic. If the feces are washed and placed in a flat dish with water, the characteristic worms may be found. All feces passed within 12 hours of the last purge should be examined. This is really the best procedure in absence of ova and, in most cases, is entirely justifiable. It is important to remember that if a purge is not given after the anthelmintic, no evacuation of the bowels may occur in time to find the worms, for in 12 hours they may be digested in the intestinal canal, and as a consequence not found in the feces. Thus the lack of a microscope will not excuse the withholding of appropriate treatment, for treatment is harmless and the worms are visible to the naked eye. Quinine is administered on flimsier evidence than that presented by the anemic jibaro of Porto Rico.

The opportunity is here seized to emphatically recommend that such treatment should never proceed from anyone but a doctor of medicine. Among those anemics not liable to have been infected by uncinariæ microscopic examinations should always be made. We consider the clinical picture as seen here very suggestive, but we do not forget that cases of profound anemia from other causes will make such a diagnosis as uncinariasis precarious. Moreover, there are concomitant diseases which may keep up severe anemia. Still further, we may expel all parasites and leave organic diseases of heart, liver, and blood-making organs (the result of previous infections) to work out a fatal effect.

The suggestive clinical features of uncinariasis are: History of one or more attacks of mazamorra, remembering that the mazamorra of the better classes is not always the mazamorra of the jibaro; pallor, using the conjunctiva as the best guide; hemic murmur; pain in the epigastrium with large appetite and still with decided digestive disturbance; meteorism; lack of pronounced diarrhea; pal-

pitation of the heart; dizziness; pain in the chest without cough; and a passive, indifferent, stupefied, or preoccupied condition of mind. For those who have the instruments but who for some reason have not examined the feces, low hemoglobin percentage, low color index, and, in certain cases, presence of eosinophilia, make, with the clinical symptoms, a still more suggestive picture. In brief, uncinariasis has been defined as a profound anemia without apparent cause. We should be inclined to add that, in so far as Porto Rico is concerned, all anemias in which sufficient cause can not be found, should be subjected to some test to determine the presence or absence of uncinaria.

As to diseases with which uncinariasis is confounded, we will only refer to the more prominent ones with which a physician in this island will have to deal.

MALARIA.

Malaria can be most accurately diagnosed by the microscopic examination of the blood. The absence of the parasites from the circulating blood in one examination does not preclude the possibility of the presence of this micro-organism in the internal organs, but once found, the evidence is conclusive. Generally speaking, malaria is not a very common disease in Porto Rico, but in certain localities in the island, as Salinas, it certainly is. There are few persons who will not say that they have at some time had "malaria," but it is a popular diagnosis for fever in any form. Indigestion, autointoxication, enteritis, "colds," typhoid fever, filiariasis, etc., are often embraced in this all-sufficient word. Malarial cachexia is really rare. This is a condition which in the south of the United States used to be almost universally confused with uncinariasis and other diseases.

TUBERCULOSIS.

In its incipient stage, where diagnosis is most important, the microscope is almost indispensable, unless we are peculiarly gifted in physical diagnosis. But anemia in incipient phthisis is oftener absent than present, although pallor is frequent. Only when a cavity exists is it that marked anemia from tuberculosis may be expected, and this does not always occur.

Syphilis very frequently produces extreme anemia in the secondary stage and should be carefully looked out for.

Diarrheal diseases and dysentery, when chronic, often produce considerable anemia, sometimes severe.

PERNICIOUS ANEMIA.

This is a very rare disease; none of us has ever seen a case in Porto Rico. The high color index, with preponderance of megaloblasts over normoblasts, should be sufficient to exclude it.

PSEUDO-ANEMIA.

We were visited by large numbers of persons in the better walks of life, who desired treatment for "anemia" because they were pale. In many it was nothing more than the normal complexion of persons living in the south of the continent; in others the lips were pallid

and symptoms of neurasthenia were present. In none of these was anemia found if 85 per cent is to be considered the lower limit of normal hemoglobin, according to the Von Fleischl apparatus. Most of them had over 100 per cent. On the ground of this complexion and occasional pallor of lips, which is usually transitory, we often hear that "everybody" in Porto Rico is anemic. Persons from temperate zones frequently note a loss of ruddy color, to a certain extent, after a few years' residence here (or much less) but many never lose their color. Those who do become pallid say they are "nervous and run down," and we are inclined to view this phenomenon as more nervous than organic.

Stengel says:

> It is very well known that certain individuals of the same family present marked pallor without exhibiting evidence of anemia in a clinical way or upon the most careful examination of the blood. * * * The explanation of such cases is found in the study of the general circulation. Sahli found among the causes of such "apparent anemia" reduction in the blood pressure with consequent deficiency of circulation in the skin. In other cases disturbances of the vasomotor system doubtless play a part. * * * In these instances there is a sudden or gradual accumulation of blood in the interior with reduction of the amount customarily present in the skin. The consequence of this is an anemic appearance without actual anemia.

In general, diseases which have been cited as productive of anemia do not so frequently produce profound anemia as is thought. Referring again to Stengel:

> Taking blood examinations of 100 consecutive cases of gastric, intestinal, cardiac, nervous, and pulmonary diseases in which a certain degree of pallor led to examination of the blood, I found the average percentage of hemoglobin to be 74 per cent.

This is 30 per cent higher than the average hemoglobin percentage of anemics here.

It is notable, also, that he considers 40 to 50 per cent a severe anemia and 50 to 75 per cent moderate.

> [NOTE.—An important addition should be made here in sprue which we have found not at all rare among the well-to-do classes. Sore mouth, the bright mental condition, and characteristic stools should lead us to consider it; and negative examinations of the stools for uncinaria, and the fact that mazamorra is absent from the personal history should exclude uncinariasis.]

PROPHYLAXIS.

Many suggestions have been made to us, and we have reviewed a large amount of literature on this phase of our labors. Some of the plans have been already proven worthless, some of doubtful value, others not applicable to peculiar conditions existing in Porto Rico, or they have too limited an application. The experiments referred to under etiology show how useless or impracticable are all attempts at chemical disinfection. Boiling or filtering the water is not necessary, as the chances for infection by this agent are negligible. The coffee plantations are, in Porto Rico, the most heavily infected places, yet the ground can not be plowed or burned off.

We are therefore left two points of attack, i. e., (1) prevention of soil pollution, (2) treatment of existing cases.

PREVENTION OF SOIL POLLUTION.

Instead of the infection being confined to mines, brickyards, etc., it is here spread over the entire island, an area of 3,606 square miles,

populated by about 1,000,000 people, scattered throughout the hilly interior, often isolated many miles from town. Here they eke out a miserable existence, victims of their insidious illness which they neither know how to avoid nor cure.

Remarkable, indeed, are some of the precautions they take to avoid certain diseases; for example, it is no uncommon sight to see people carrying an umbrella on a clear night to keep the dew from an injured finger. If the danger of soil pollution could be so engrafted upon their minds, half the battle would be won.

Every possible means should be used to disseminate the facts among these people. A small pamphlet written in simple, plain language should be published, and so generously and repeatedly distributed throughout the island that no house should be without it. Illiterate as most of them are, they would find some one to read and discuss it, for it is to them a matter of life and death, and they know it. This pamphlet should explain the cause of their affliction; how, by defecation upon the ground, the ova of the parasite are spread about; how they develop under the proper conditions of temperature, dampness, and shade; and how the larvæ gain entrance to the human body and produce the disease. The necessity of sanitary privies should be made very clear.

A suggestion of Dr. A. Stahl affords another excellent means of reaching them. It is that the teachers in the schools, especially in the country and smaller towns, should assist in the promulgation of this sanitary doctrine, not only among their pupils but wherever they can. The insular police stationed in the country districts could exert a powerful influence by authoritative counsel. We know of one, a former patient, who announced his intention of doing what he could. Indeed, it is not surprising that those who have been cured should become enthusiastic in this work.

If the above propaganda be thoroughly carried out, there would be no necessity for a law requiring the construction of privies for every house. The effect, however, would be less felt in some circumstances, and compulsion should be used if necessary to have privies, either portable or fixed, on coffee plantations, sugar plantations, public works, etc., wherever large or small bodies of workmen are congregated. In connection with this idea, and for the benefit of those who believe that the country peon will pay no attention to such advice, we were told that as a result of our labors in Utuado the workmen employed in road building annoyed the foremen by demanding privies near their work.

Privies may be of the simplest form, practically without cost except for a little labor. A hole in the ground surrounded by a thatch or bark lean-to is sufficient. When nearly full, it can be covered with earth, and another dug. When working in the field, the laborer is scarcely ever without his hoe or machete, which could be used for covering the excreta voided there of necessity.

TREATMENT OF EXISTING CASES.

Each person who harbors this parasite, whether suffering from anemia or not, is a focus of infection to others; hence the reduction of these foci becomes a most important prophylactic measure, and it

should be emphasized that the slight cases are the most dangerous, because they often do not present themselves for treatment, but must be sought out. The present system of municipal aid is entirely inadequate to accomplish the results desired, as the municipalities lack sufficient resources; some have no physician, nor even medicines. Thus, of necessity, it becomes the imperative duty of the insular Government to take hold of this work with decision and energy.

The demand for assistance and treatment for sufferers from this disease is already being felt in those districts where the commission has worked, and proves the efficacy of the plan instituted. But these municipalities can not pay for necessary professional attendance, supply medicines, nor even house in their small hospitals the numerous grave cases that exist within their boundaries. Moreover, this demand will soon spread through all the island, as it is already noticeable in those parts where the efforts of enthusiastic physicians are combating the disease with brilliant success, although having but limited resources.

For these reasons, the commission believes that a methodic and scientific organization sustained by the Government and cooperating with the municipalities in their charitable institutions will be the most feasible plan of operation and give practical results.

This organization could be confided to a commission that would establish a central station with a small portable hospital annexed, remaining a specified length of time in each district, and locating branches in suitable places, until there would be formed a complete system of dispensaries and hospitals for the exclusive treatment of this plague.

Having indicated the lines along which the commission believes preventive measures should be taken, it is not within our province to discuss the question of expense nor where shall be found the necessary funds for this work. While not losing sight of the economic condition of the country, the sanitarian and physician, face to face with the evil which they have to prevent and cure, should not, indeed can not, compromise to financial conditions their prophylactic ideas, founded upon scientific facts. It remains for others to harmonize the exigencies of "Salux populi suprema lex," with the precarious state of the contingent of affected who constitute, in Porto Rico, 90 per cent of the rural population.

As Rome was not built in a day, neither can success be rapidly attained in the elimination of this disease from Porto Rico. The measure of results will depend upon systematic and continued hard work, begun gradually and extended as rapidly as consistent with efficiency.

It will require years to accomplish the perfect result, but the interest on the labor and money expended will not be so long delayed, as each year will return multiplied benefits in the form of lowered death rate, increased efficiency of the laborer, reduced demands upon public charities, etc.

Treatment.

The object of treatment is, of course, to remove the cause by expulsion of the parasites. In many light and moderate cases this will suffice, but in old chronic cases, and in those where the disease has

reached a severe grade, some regenerative treatment should follow the specific.

There are only three drugs worthy of serious mention: thymol, male fern, and beta-naphthol.

THYMOL.

This was first used by Bozzolo in 1880. It is preferred to male fern in the United States and England. Sandwith says he "went through a weary apprenticeship of failing to get rid of the parasite with other drugs."

In our work the mode usually adopted in its administration was the following:

In the evening, a dose of either magnesium or sodium sulphate was exhibited. In the case of the latter, a less nauseous draft, 30 grams seemed sufficient, for to give more would be to often precipitate a too exhausting diarrhea. The object to be attained is the emptying of the bowels so that the anthelmintic will act upon an exposed intestinal mucous membrane. On the next day, the patient is kept in bed without food until 1 p. m., and is given 2 grams of finely powdered thymol in capsules at 8 a. m.; at 10 a. m. this dose is repeated, and at 12 m. another purge of the salts. This was the method employed in our outpatients, but in our hospital we have occasionally deviated from it in order to compare the efficacy of thymol with that of other drugs. We believe that the second purge is needful, because it is not desired that thymol be absorbed, and sodium or magnesium sulphate is an antidote. When a soluble sulphate arrives upon the scene, all the damage that the anthelmintic is going to do to the worm, has been done, and from that time it is proper to hurry the drug out of the intestines. For the same reason we warn against all solvents of the drug while it remains in the digestive canal. Such are alcohol, ether, glycerine, turpentine, chloroform, and oils.

Nearly all our patients took their medicine in their own homes. Some undoubtedly failed to take it properly, but generally they obeyed to the letter the directions given. There were exceedingly few instances when the medicine was carried home and not taken at all. This we know from subsequent examinations of their feces and from general results of treatment. In this respect we were agreeably surprised, as we had been warned that our plans would be frustrated by the throwing away of the medicine. Those who constantly attended the clinic until cured or until we left often dreaded the administration of thymol on account of its accompanying purge, and sometimes from the dizziness and burning of the stomach produced. This is undoubtedly one of the various reasons why 507 of the Utuado cases failed to repeat their visits until cured, apart from the long distances to be covered over mountain trails, and the time lost from their daily occupations. Many ceased to return because they felt well after several doses. In general, however, they will take anything that will rid them of their anemia, no matter at what sacrifice, no matter what the distance to be traversed. We have frequently seen them come from barrios where they had been obliged to start out for the hospital at midnight to reach there in time for examination and treatment, and many times it happened, where the crowd was too large to be handled in the morning hours, that 200 persons

have patiently waited from daybreak to late afternoon before receiving attention.

It may be asked, why was thymol preferred to other drugs said to be less dangerous? We have not shared the opinion of many as to the danger of administering thymol under a certain amount of precaution. The experiences of two of us in some hundreds of cases in Ponce demonstrated that its danger was greatly exaggerated and generally resulted from a solution in alcohol or oil. We came to know that thymol was an exceedingly inoffensive drug, as a result of our further acquaintance with it, for we have had no death that we can attribute to it unless it was the indirect cause of death in cases 18, 25, and 76 (p. 149) by acting unfavorably in a chronic enterocolitis. This tendency to irritate the mucous membrane is the only serious objection we have found with it, although it is perfectly well known that when absorbed it has produced death. Our practical observation is that it is not absorbed to any great extent. Patients frequently volunteered the information that they had no effect from the purge and some remained even two and three days before a movement of the bowels resulted. Absolutely no symptoms of intoxication were seen in such persons, and now and then they failed to show ova thereafter in the stools. In spite of solemn warnings given each and every one, at times they confessed to having taken "a swallow" of rum on feeling dizzy from the drug, yet no cases of poisoning occurred, although we had one with quite severe symptoms of collapse. It was sometimes given to pregnant women to save life. Of the 11 cases of pregnancy in which it was so administered, one was probably in the second month, one in the third, six in the fifth, three in the sixth. Two women in the fifth month aborted, but one did so six days after thymol was given, and her condition was so serious from uncinariasis and the time so long after its administration that it is not believed that she aborted as a result of the drug. In view, however, of the other abortion, possibly due to thymol, it should not be used unless it is seen that more risk is contracted by withholding than by giving it. Several women were refused treatment on this account. On several occasions nursing mothers were given thymol without bad effect to either mother or child and without serious diminution in the secretion of milk.

One case, in particular, is worthy of remark: The woman was ghastly pale and struggling to nurse a puny baby a month old, with a daily decreasing secretion of milk. The child was crying with hunger and was given a little modified milk the day on which the mother was given a full dose of thymol. It was placed at breast on the night of the same day. After a series of such doses of thymol both mother and baby became fat, of good color, and perfectly well. The effect on the milk was remarkably prompt, causing it to become very abundant.

One patient repeatedly vomited thymol when given with salts but held it down on changing the purge to podophyllin. In several instances the thymol was taken in water without effecting emesis, according to the patients' statements. Manson states that at times thymol gives rise to a very unpleasant form of intoxication with vertigo, excitement, etc., and the urine may become dark as in carbolic acid poisoning, reporting Thornhill's case of fatal collapse due to

administering liquor at the time of the second dose of thymol. Scheube adds to Manson's list fall of temperature, retardation of the pulse and respiration, burning in the stomach and esophagus, and, finally, delirium and collapse. A tendency to vomit is seen at times. which may bring the drug in contact with the laryngeal mucous membrane and cause strangling. Boycott and Haldane, who used, in the Cornwall endemic, three successive doses of thymol, in capsule or emulsion, at intervals of two hours, state, in regard to the effects of thymol, "no unpleasant effects were observed. Patients were all treated at home so results could not be so well observed as at the hospital."

The same remark could be made of the work here although some did have dizziness, burning of the stomach, and a temporary increase in debility. The majority, however, had no symptoms from the drug. Excitement, burning in the urethra, and olive green or smoky urine were not observed.[1] Nevertheless, as much care as possible was exercised and very ill patients were admitted to hospital and given preparatory treatment. Had it not been for this, our experiences in the use of this drug might have been much less fortunate. Unfavorable to the administration of thymol are, great debility, very old age, pregnancy, advanced cardiac or other organic disease, a tendency to vomit, anasarca, chronic diarrheas, and dysentery. Sandwith says: "Warned by the death of at least one of my patients I have always administered to feeble men 25 grams of brandy with each 2 grams of thymol." We are not in accord with this, as we believe that whisky or brandy hypodermically, or nitroglycerin, strychnine, and digitalin are preferable for reasons stated above, though we feel sure that many of our patients neglected to observe our warning in regard to rum with thymol. In fact, our principle has been to stimulate and support all very advanced cases before the exhibition of thymol. The effect of a full dose on edematous persons is generally marked. Usually the next day the edema is very much increased and may prove fatal from edema of the brain or lungs, not to speak of the dangerous increase of an already extreme ascites.

We have referred to the tendency to aggravate a case of dysentery or diarrhea. A most important detail in the treatment is the purge. It is believed that too powerful purges will kill a debilitated subject more quickly than thymol.

The dose of thymol was graduated according to age, but more especially according to the degree of debility, etc., of the patient. Thus it happened that many times a very weak subject took 1 or 2 grams the first visit and the full dose thereafter, when his condition had been improved from the number of worms expelled. We do not agree with some English writers, who state that large doses are always needed. They are preferable, but small doses, by expelling a goodly number of parasites, will often tide over a patient who might not resist a full dose. We have practically proven this by inspection of feces after small doses of thymol and observing the happy results obtained therefrom. One thing seems certain, as the total amount must reach the intestine within the space of two hours (for we are to kill parasites, not merely sicken them), the blow must fall heavily.

[1] Olive green urine was later observed in Albonito, 1905.

Three decigrams every three or four hours is not a proper use of thymol. We have given 0.5 gram to little children under 5 years with excellent results. In general, between 5 and 10 years, 1 gram is sufficient; between 10 and 15, 2 grams; between 15 and 20, 3 grams; between 20 and 60, 4 grams; above 60, 2 or 3 grams is generally all that we should give.

A tabulated chart showing the doses employed by us in 4,482 cases, arranged according to the age of the patient and the number of times a specific dose was given, is here seen. It should be remembered that the total number of persons is more than 4,482, for it often happened that one received different amounts at different times.

ONE-HALF GRAM THYMOL.

Age.	Times.				Total persons.	Total times.
	1	2	3	4		
Under 5	20	3	2	1	26	36

ONE GRAM THYMOL.

Age.	Times.								Total persons.	Total times.
	1	2	3	4	5	6	7	8		
Under 5	4	2	1	2	.....	.....	.....	.....	9	19
5 to 9	83	109	70	40	15	8	6	1	332	844
10 to 14	69	31	31	19	7	.....	.....	.....	157	335
15 to 59	4	1	.....	.....	.....	.....	.....	.....	5	6
Total	160	143	102	61	22	8	6	1	503	1,204

TWO GRAMS THYMOL.

Age.	Times.												Total persons.	Total times.
	1	2	3	4	5	6	7	8	9	10	11	12		
5 to 9	33	36	27	9	4	3	....	3	....	....	....	....	115	284
10 to 14	132	216	139	69	31	11	6	3	....	....	....	....	607	1,544
Over 14	40	16	8	9	....	1	....	....	....	....	....	....	74	138
Total	205	268	174	87	35	15	6	6	....	....	....	....	796	1,966

THREE GRAMS THYMOL.

Age.	Times.												Total persons.	Total times.
	1	2	3	4	5	6	7	8	9	10	11	12		
Under 10	2	....	....	....	....	....	....	....	....	....	....	....	2	2
10 to 14	75	84	42	20	13	6	3	....	....	1	....	....	244	581
15 to 59	203	171	107	49	16	8	5	1	1	....	....	....	561	1,242
Over 60	14	19	10	8	....	1	....	....	....	....	....	....	52	120
Total	294	274	159	77	29	15	8	1	1	1	....	....	859	1,945

FOUR GRAMS THYMOL.

Age.	Times.												Total persons.	Total times.
	1	2	3	4	5	6	7	8	9	10	11	12		
Under 10	1	....	....	....	....	....	....	....	....	....	....	....	1	1
10 to 14	7	6	3	....	....	....	....	....	....	....	....	....	16	28
15 to 19	69	113	77	48	18	7	4	1	....	....	....	1	338	808
20 to 49	391	560	479	344	135	65	21	16	1	....	....	....	2,012	5,673
50 to 59	73	53	39	21	12	3	2	1	1	....	....	....	205	489
Over 60	11	7	4	4	2	....	1	....	....	1	....	....	30	80
Age not given	2	1	2	....	....	....	....	....	....	....	....	....	5	10
Total	554	740	604	417	167	75	28	18	2	1	....	1	2,607	7,179

Of 185 of Sandwith's cases, 95+per cent were cured in five or less doses, about the same result as we have secured.

There is no complete record of the number of doses given in Bayamon, but we have calculated that about 2,000 doses were given.

The following tables show the number of times thymol was administered in 4,482 cases, general series, Utuado. A details the number of times it was used; B the number of times it was needed to expel all uncinariæ; C the number of times it was given without effecting dislodgment of all uncinariæ:

Number of doses.	A.		B.		C.	
	Persons.	Times.	Persons.	Times.	Persons.	Times.
1	935	935	1,518	1,518	358	358
2	1,334	2,668	1,166	2,332	190	380
3	1,011	3,033	518	1,554	133	399
4	667	2,668	247	988	88	352
5	288	1,440	104	520	44	220
6	143	858	47	282	22	132
7	57	399	19	133	7	49
8	29	232	6	48	5	40
9	6	54	3	27	2	18
10	2	20	1	10	0	0
11	1	11	1	11	0	0
12	1	12	0	0	0	0
Thymol not given	8	0	0	0	0	0
Total	4,482	12,330	3,630	7,423	844	1,943

Following is a table showing the days needful to cure, arranged in groups of 10, and the number of persons classified according to the severity of the disease.

Days.	Slight.	Moderate.	Marked.	Total.
1 to 9	367	2	0	369
10 to 19	428	217	2	647
20 to 29	168	239	54	461
30 to 39	52	110	75	237
40 to 49	28	60	88	176
50 to 59	12	41	68	121
60 to 69	10	23	34	67
70 to 79	3	21	25	49
80 to 89	1	3	16	20
90 to 99	2	0	2	4
Total	1,071	716	364	2,151

As to the number of days necessary to cure, it is needful to classify our cases according to degree of severity of the disease. In general, the time to cure depends upon the latter factor. Leichtenstern and German writers of later date believe that the recently infected are the most difficult to cure from the small size of the worm and the readiness with which it is covered by mucus and folds of mucous membrane. We hardly believe that such a generality obtained. Old infections were to us very difficult to eradicate, but we quite agree that very early infections are still more so. We know of many cases where thymol given previous to maturity of worms failed to expel them. This may be due to encystation of the larvæ in the submucosa.

It was discovered late in our work that, whether from suspended ovulation, the result of sickening of the worm, or from whatever cause, ova disappeared from the feces to appear again in two or three weeks, or even longer. In some cases this was certainly due to subsequent infections. In view of these facts, we came to give thymol, even in absence of ova, when there was persistently low hemoglobin and continuance of symptoms. Many cases of failure to cure are thus due to a suspension of anthelmintic treatment in absence of ova from the stools, for the resumption of it caused the hemoglobin to rise with extraordinary rapidity. From this it may be deduced that about 10 per cent of our cases might have reached a higher hemoglobin percentage. With this end in view 3,964 doses of thymol were administered after all ova had disappeared.

With the exceptions noted, thymol was given once a week as long as ova remained in the feces; 97.8+ per cent of those who expelled all their uncinariæ received thymol five times or less; 41.8+ per cent expelled all in one dose; 32.1+ per cent in two doses; 14.2+ per cent in three doses; 6.8+ per cent in four doses; and 2.8+ per cent in five doses. Of 4,474 cases (excluding special cases) which received thymol, 81.1+ per cent expelled all uncinariæ, but, subtracting 507 who never returned or ceased to return after two or more doses, this percentage rises to 91.5+.

This is to say that 68.6+ per cent were cured in less than 30 days; but about two-thirds of these were light cases; 93.4+ per cent of the moderate cases averaged two months to cure, but 68.4+ per cent of these only one month; 15+ per cent of the marked cases required less than 30 days; 63+ per cent from 30 to 59 days, and 21+ per cent from 60 to 100 days.

We do not believe it necessary nor justifiable to administer more than 4 grams of thymol at a time nor to repeat this oftener than once a week, on account of the tendency of thymol in some persons to irritate the mucous membrane of the bowel.

MALE FERN.

The official "oleoresina aspidii" (United States Pharmacopœia) is a violent poison in overdose, according to H. C. Wood (Therapeutics, Its Principles and Practice, 11th ed., 1900), "producing excessive vomiting and purging, with general weakness, tremors, and cramps in the extremities, increased reflexes, amaurosis, and, finally, in some cases, violent tetanic convulsions, with opisthotonos, stupor deepening into coma, and collapse. Icterus is sometimes apparent * * * 6 drachms (22.2 grams) has several times proved fatal in the adult. Disturbances of the special senses is a not infrequent symptom in

aspidium poisoning * * * more commonly amblyopia or complete amaurosis occurs. One or both eyes may be affected, and total blindness, with gray atrophy, may remain as a permanent condition." According to Quirll, the fatal result is partly due to the violent irritation of the gastrointestinal tract and is partly the result of an influence upon the nervous system.

These symptoms are rarely observed. It is a remedy of great antiquity as one of the best anthelmintics known for tapeworm and, lately, found to be very efficacious in uncinariasis; it is almost exclusively used in the continent of Europe, preferred because it was thought less dangerous and more effective than thymol. It is a very frequently adulterated drug, is variable in strength, much more costly than thymol, and liable to deteriorate, especially in this climate. We can not believe it less dangerous than thymol, and it is certainly as disagreeable to take, if not more so, from our short experience with it.

We preceded the administration of filix mas by 0.13 of calomel and 0.03 of podophyllin. The following day 8 grams of the ethereal extract was exhibited, and at noon a small dose of salts, if needed. In some cases where parasites were resistant to thymol this gave good results, and in others it did not. It seems to cause more dizziness and nausea, and patients generally complained that they felt sicker and weaker after it than after thymol. These effects were certainly corroborated by their appearance. Undoubtedly both drugs are very efficacious, and a choice between them will always depend upon the physician's personal preference. It is evident, however, to us that the extract of male fern is inferior to thymol here in Porto Rico for reasons given, and we further consider that its use should be restricted to those cases in which thymol fails to have a satisfactory effect. A change from thymol to male fern, or vice versa, seems at times very effective.[1]

BETANAPHTHOL.

We have expelled over a thousand uncinariæ by a single dose, and have obtained several cures from its use, but we have not had extended experience with it, owing to the fact that we had concluded our field work when Bentley's important article fell into our hands. He states (Indian Medical Gazette, Calcutta, Apr., 1904, vol. 29, No. 4) that he abandoned thymol two years ago to use betanaphthol, and has used it in several thousand cases with excellent results. It is administered just as is thymol, save that 2 grams are employed instead of 4.

RESULT OF TREATMENT.

The following is a classification of the results obtained in Bayamon:

	Persons.
Cured	52
Practically cured	91
Improved	228
Unimproved	52
Result not recorded	522
Died	2
Total	947

[1] The real shortcomings of male fern were not observed until the work of counting the worms expelled by each dose was taken up. See second report.

In Utuado 4,482 persons composed a general series, in which only cardinal points were noted. The following table gives the results according to the clinical type:

Result.	Slight.	Moderate.	Marked.	Total.
Cured	1,071	716	364	2,151
Practically cured	13	51	209	273
Improved	61	170	1,264	1,495
Unimproved	1	8	25	34
Died	2	2	18	22
Never returned	35	55	134	224
Ceased to return	38	59	186	283
Total	1,221	1,061	2,200	4,482

From the 61 special cases we have extracted the following summary:

Result.	Slight.	Moderate.	Marked.	Total.
Cured	1	1	40	42
Practically cured	0	1	12	13
Improved	0	0	3	3
Died	0	0	3	3
Total	1	2	58	61

Grand total of 5,490 cases:

Cured	2,244
Practically cured	377
Improved	1,727
Result not recorded	522
Never returned	224
Ceased to return	283
Unimproved	86
Died	27
	5,490

One death has been excluded from this list because it does not belong to the commission's field work. "Cured" should be taken to mean disappearance of all symptoms of the disease, with absence of ova from the stools, and a hemoglobin percentage of 85 (v. Fleischl apparatus). This class forms 40.8+ per cent of the whole number. The percentage of cured in Utuado alone was 48+. "Practically cured" has the same meaning, with the exception that the percentage of hemoglobin lies between 70 and 85. These form 6.8+ per cent of the total. Added to the number of cured, the percentage would be 47.6+ of the entire number and 54+ for the Utuado cases. "Improved" form 31.4+ per cent of the total; in Utuado they formed 32+ per cent of those cases. Thus the percentage of cured, practically cured, and improved to the whole number is 79. In Utuado these form 87+ per cent of all cases treated there. "Unimproved" form 1.5+ per cent of the total, and the "Deaths" 0.5— per cent.

Those who never returned after the first dose, or who ceased to return after attending a short while, form 18+ per cent of the total. In such persons we had no opportunity to complete the treatment.

The majority of cases were from two weeks to two months under treatment, excluding the last-named class. The difference between the results obtained in Bayamon and those of the Utuado series lies

in the fact that few of the former exceeded three weeks of treatment. In other words, all but 53 of these cases were incomplete, for many more would have been cured in three weeks' additional treatment. Many here noted as "Improved" and "Practically cured" are now well, discounting those who have become reinfected, and taking into account the 522 of whom there is no record. Thus the difference lies chiefly in the length of our stay at each place—in Bayamon but 7 weeks against 14 in Utuado.

We have accurate data concerning the number of visits paid us by our patients only in the Utuado cases:

	Number of persons.	Number of times.
One visit	331	331
Two visits	664	1,328
Three visits	955	2,865
Four visits	861	3,444
Five visits	667	3,335
Six visits	446	2,676
Seven visits	265	1,855
Eight visits	166	1,328
Nine visits	84	756
Ten visits	29	290
Eleven visits	11	121
Twelve visits	1	12
Thirteen visits	0	0
Fourteen visits	2	28
Total	4,482	18,369

The percentages of hemoglobin of the cured, practically cured, and 578 of the improved in the Utuado general series may be detailed as follows (special cases are excluded as they appear elsewhere):

	Persons.
Cured:	
Between 85 and 89	726
Between 90 and 94	411
Between 95 and 99	258
Between 100 and 109	426
Over 110	330
Total	2,151
Practically cured:	
53 per cent[1]	1
70 per cent	57
71 per cent	8
72 per cent	20
73 per cent	21
74 per cent	13
75 per cent	41
76 per cent	17
77 per cent	7
78 per cent	17
79 per cent	6
80 per cent	28
81 per cent	6
82 per cent	10
83 per cent	3
Not given	18
Total	273

[1] This patient, though only possessing 53 per cent Hb., had good color and said he felt completely cured.

Improved (578 cases):	Persons.
Between 20 and 29 per cent	3
Between 30 and 39 per cent	38
Between 40 and 44 per cent	36
Between 45 and 49 per cent	55
Between 50 and 54 per cent	92
Between 55 and 59 per cent	106
Between 60 and 64 per cent	141
Between 65 and 69 per cent	107
Total	578

Classification of the other cases in this series according to the clinical type is as follows:

Never returned:	Persons.
Slight cases	35
Moderate cases	55
Marked cases	134
Total	224
Ceased to return:	
Slight cases	38
Moderate cases	59
Marked cases	186
Total	283
Died:	
Slight cases	2
Moderate cases	2
Marked cases	18
Total	22

The unimproved and 917 of the improved are not classified.

Although the actual results are here chronicled, no accurate conception can be formed of the effect of expulsion of all uncinariæ upon the patient sick of uncinariasis unless the progress of convalescence be followed in person. Children in the extreme grades of the disease, without life enough to take interest in things that belong to childhood, often rapidly gain in color and spirits to such an extent as to change them entirely in physique and character. This is, of course, by no means confined to children. A curious effect of the first dose of thymol is frequently seen in that, although the anemia usually remains as profound as ever, the patient looks and feels better. This is the chief reason why our large clinic was so regular in its attendance, notwithstanding the inconvenience entailed.

In older persons, who for a long time have been anemic and debilitated by many other concomitant conditions, a slow convalescence is frequently seen, due to a loss of power of regeneration of the blood; but as frequently we see an apparently hopeless case, turned away after six or seven doses of an anthelmintic in the belief that a return to health is impossible, appear six months later, healthy and with normal blood. There is a very decided tendency to slow recovery when food is especially poor, and a small percentage of our cases who were not cured fall in this group. Another element to be considered is the presence of even a few worms, so few, perhaps, that ova in the feces are not found.

One of the most surprising results appeared when a division of the cured cases was made into those who took iron and those who did not, viz:

Iron in relation to days to cure (groups of 10), and grade.

Days.	Slight.	Moderate.	Marked.	Total.
1-9	0	0	0	0
10-19	15	8	2	25
20-29	74	106	24	204
30-39	30	83	56	169
40-49	26	50	73	149
50-59	11	35	50	96
60-69	10	22	33	65
70-79	3	20	24	47
80-89	1	2	16	19
90-99	2	0	2	4
Total	172	326	280	778

No iron in relation to days to cure (groups of 10), and grade.

Days.	Slight.	Moderate.	Marked.	Total.
1-9	367	2	0	369
10-19	413	209	0	622
20-29	94	133	30	257
30-39	22	27	19	68
40-49	2	10	15	27
50-59	1	6	18	25
60-69	0	1	1	2
70-79	0	1	1	2
80-89	0	1	0	1
90-99	0	0	0	0
Total	899	390	84	1,373

These results should be considered in the light of the following explanation. Iron was not given to patients at their first visits, except in very severe cases, and if they progressed well it was oftentimes never given. When progress was slow iron was given in the form of Blaud's, Vallet's, or Blancard's pills, 3 to 6 daily.

It will be noticed that slight cases readily recover without iron, and here the difference in the tables is more marked, while there is less difference among the marked cases in proportion to their number. In other words, the more resistant cases of all grades received iron, but even then did not generally recover as rapidly as those less rebellious without, for while ferruginous preparations seem to act readily in some instances, still, in the majority its effect was not very marked. The rapidity of cure is due, apparently, more to the personal equation of the patient and the rapidity with which the parasites are expelled than to the amount of reconstructive treatment. Thus it is quite difficult to accurately judge the comparative value of different iron preparations, yet it was noticed, even by some patients, that Blaud's pills gave more rapid results.

In a series of 22 cases selected to represent approximately the various grades of the disease and all ages of patients, no reconstructive treatment of any kind was given, so as to particularly observe the effect of expulsion of the uncinariæ alone. The results were: Cured, 7 (31.81+ per cent); practically cured, 2 (9.09+ per cent);

improved, 10 (45.45+ per cent); unimproved, 3 (13.63+ per cent). Their average of hemoglobin percentage on entrance was 44.59+; final average, 64.67+. These percentages compare very favorably with the general results.

It is the testimony of many patients and physicians here that iron without expulsion of uncinariæ, is of little benefit and oftentimes of positive harm, inciting diarrhea. This may depend somewhat upon the form given.

Iron, therefore, while generally advantageous, especially in severe cases, has a much less important rôle in the therapeutics of this disease than anthelmintics.

BAYAMON.

Case 1.—J. M. Admitted, March 6; ex-soldier in Spanish Army. Native of Province of Galicia, Spain. Has lived in Porto Rico 17 years. First fell ill while working on a sugar plantation near Bayamon, and his first trouble was a sharp attack of mazamorra. His employer paid him well, and his food was always excellent, with plenty of meat, etc. Typical severe case of chronic uncinariasis, with general edema, atrophy of skin, and advanced nervous and circulatory symptoms. A curious symptom was night blindness, which disappeared under treatment.

March 6: Hb., 27 per cent; reds, 3,728,000; whites, 8,400; eosinophiles, 7 per cent. On April 20 he had Hb. 81 per cent and eosinophiles 28.8 per cent. He became our most trusted and efficient nurse and left us, a powerful ruddy man, with 98 per cent Hb.

Case 4.—A. S. Municipal hospital. Age, 73; about moribund, with tremendous edema of whole body; pulse, 150; dilated heart; all but unconscious. Hemoglobin, 16 per cent; eosinophiles, 2.5 per cent. We were told that the man had been for some time under stimulative treatment, and concluded that the only chance he had was to administer thymol. One gram was given with hypodermic stimulation. He died on the 12th, five days afterwards, but without having shown the slightest symptom of intoxication from thymol.

Case 8.—J. O. Admitted, March 8. Age, 60; female. Was a celebrity in town as the "swollen woman." Usual symptoms. Hb., 65 per cent; eosinophiles, 43.5 per cent. On the 21st of March Hb. was 103 per cent. Perfectly well.

Case 16.—J. T. Admitted, March 11. Age, 30; bookkeeper of a well-known company in San Juan; a man of education and refinement; lives well; used to be very ruddy and well. In October, 1902, went hunting, and in kneeling bare-kneed in the mud to take aim at a bird contracted mazamorra. The peon who accompanied him also contracted the infection. He said the itching began very soon after infection and went through all the typical changes from papule to pustule. He began to get pallid in January, 1903. Tried many iron tonics; ate great quantities of roast beef; took patented beef juices, and all failing utterly his physician advised a European trip, which he made. He returned to the island practically no better and came to us, presenting a picture of severe and what promised to be a fatal chronic uncinariasis. There was no complication of any sort, and his case was thoroughly studied. An enormous number of ova of uncinaria was found in his stools. On March 11 his Hb. was 24 per cent, eosinophiles 8 per cent; March 18, Hb. 28 per cent, eosinophiles 10 per cent; April 1, Hb. 54 per cent. On April 30 he was in apparent good health and color. On October 7 he came to our office, ruddy, strong, and without a sign of his previous disease. Hb., 115 per cent; eosinophiles, 17 per cent.

SYNOPSIS OF ALL DEATHS.

The majority of deaths occurred in our hospital, but to get a complete list of all deaths among our patients, the official copies of death certificates for the entire district of Utuado, kept in the registrar's office in that city and covering the period of our sojourn there, was compared with an indexed list of our patients, and a few more were found. This was not done for the Bayamon cases, but their lesser number made it possible to keep track of them.

Of 5,500 cases of anemia, 5,490 of which were due to uncinariasis, we lost 27 patients. Thirteen of these died of uncinariasis, pure and simple, and of them

5 never received an anthelmintic. Nine died of other diseases or of complications, with uncinariasis as a more or less potent contributing factor. Two of these died of direct sequelæ of uncinariasis. Five died of diseases in which uncinariasis was not, even remotely, a contributing cause.

Thus our total mortality from all diseases was 0.49 per cent. Our mortality for uncinariasis alone was 0.23 per cent, and including all those who died from uncinariasis alone or as a concurrent cause, 0.41 per cent.

BAYAMON.

Case 4.—A. S. In municipal hospital for some time previous to March, 1904. Arrived in last stages of chronic uncinariasis with tremendous anasarca. Had received stimulants, etc., in hope of building up his strength preparatory to taking anthelmintic, but without success. Hemoglobin 16 per cent, E. 2.5 per cent, P. 91 per cent, S. L. 5 per cent, L. L. 1.5 per cent. In view of the fact that the patient's only chance for recovery was specific treatment, 1 gram of thymol was administered, preceded and followed by magnesium sulphate. No bad effects of the drug were observed, but the patient steadily sank, and, on March 12, succumbed from exhaustion.

Cause of death: Chronic uncinariasis, extreme grade.

Case 207.—J. C. Aged 10, extremely emaciated but not very anemic (Hb. 65 per cent). He stated that he walked from Ciales with some people who abandoned him on the way. Was very weak. Deglutition very difficult owing to stricture of the esophagus. Infection by uncinariasis recent and severe. One day of concentrated food and stimulation. Two grams of thymol with magnesium sulphate was administered on second day in hope of ridding him of at least some of his uncinariæ, but he died of exhaustion on the third day.

Cause of death: Stricture of the esophagus.

Contributing cause: Privation and acute uncinariasis.

UTUADO.

Cases 17, 33, and 42 are given in full under the account of special cases, Utuado series.

Case 18.—G. C. Admitted to hospital May 11; male; age, 40. Stools were very liquid and contained much mucus but no blood. History of severe intermittent diarrhea. Many ova of uncinaria and ascaris. Was profoundly anemic and emaciated, but had no edema. Was extremely weak. Hb., 19 per cent. Given 4–40 on May 13. He seemed much better in the next two days, but on the 16th he was attacked by a furious diarrhea, with much weakness. Given opium and bismuth and hypodermic stimulation by strychnine and digitalin. This treatment was continued till day of death, May 20.

Cause of death: Chronic entero-colitis. Contributing cause, chronic uncinariasis, severe grade.

Case 25.—M. H. Admitted to hospital May 11; male; age, 55; marked case; many ova of uncinaria; Hb., 30 per cent. Given 4–40. Left hospital May 17 slightly improved. Readmitted, with profuse diarrhea, May 31. Died June 9.

Cause of death: Chronic uncinariasis, severe grade, and chronic entero-colitis.

Case 55.—J. S. Female, 35 years of age; many ova of uncinaria. Was brought to hospital in a hammock, dying with profound anemia and extreme anasarca. Energetic stimulation was administered hypodermically, but she succumbed nine hours after her arrival. She did not receive an anthelmintic.

Cause of death: Chronic uncinariasis, extreme grade.

Case 76.—L. M. Admitted to hospital May 13. Age, 70; male. Seemed to be suffering more from old age than anything else, but was anemic and had ova of uncinaria in his stools, which were dysenteric with blood and mucus. He was given 2–30. From that time on he received opium and irrigations of the colon for his dysentery and stimulants for debility. He died June 12.

Causes of death: Senility and dysentery. Contributing cause: Chronic uncinariasis.

Case 109.—N. M. Admitted to clinic as out-patient May 14. Female; age 35. Had marked anemia and a great many ova of uncinaria. She also had advanced pulmonary tuberculosis. Given 2–30 and never returned; dying the middle of July of pulmonary phthisis.

Cause of death: Pulmonary tuberculosis.

Case 182.—G. C. Admitted May 13 to hospital. Age, 58; male. Almost moribund with dilated heart and marked anasarca. Had some anemia and many ova of uncinaria in stools. For two days he received hypodermic injections of strychnine and digitalis, and, on May 15, 2–15. From this time until the 19th the injections were continued. On the latter date, the hypodermic medication was supplanted by tincture of nux vomica and digitalis. Opium was administered to control a short attack of diarrhea. Adrenalin was added to the other cardiac remedies, but in spite of all we were obliged to perform paracentesis to relieve him of the pressure caused by the extreme ascites. May 29 he felt much better and 4–20 was administered. June 6 the ascites was worse than ever. No albumin in urine. Paracentesis repeated and 10 liters of fluid removed. June 15 the anemia was much improved. He had 65 per cent of hemoglobin, but the heart signs were worse. Died July 16, despite all effort to establish compensation of the heart.

Cause of death: Dilatation of the heart due to organic lesions secondary to chronic uncinariasis, marked grade.

Case 183.—P. A. Admitted to hospital, May 13. Age, 70; female. Was brought in hammock. Was in last stages of chronic valvular disease of heart, a probable sequela of chronic uncinariasis judging from her previous history. Ova of uncinaria found in stools. Hb. 69 per cent. Treatment: Hypodermic stimulation by means of strychnine and digitalin. No anthelmintic administered. Died May 20.

Cause of death: Mitral insufficiency and dilatation of heart.

Case 405.—I. H. Admitted to hospital, May 21. Age, 55; male. Marked case. May 23 given 3–25. He was sent home May 25, at his own request. June 24 his card was brought by his daughter who stated that her father was very sick; that he was very constipated and vomited all he ate. On July 9 his daugher brought her father's card, saying that he was very weak and had profuse diarrhea. He was sent opium and astringents, but died about the middle of the month.

Cause of death: Chronic uncinarias, severe grade.

Case 407.—B. C. Admitted to hospital, May 23. Age 25; female. Light case of uncinariasis but had extreme grade of pulmonary tuberculosis with cavities in both lungs. Ova of uncinaria found in stools. May 24, 2–20. June 4, few ova of uncinaria. Given 4–25. Died at home in latter part of June.

Cause of death: Pulmonary tuberculosis.

Case 536.—M. A. Admitted to clinic as out-patient, May 29. Age, 15; female. Had marked anemia; many ova of uncinaria; given 2–25. June 14, some ova uncinaria; given 2–25. June 26, no ova uncinaria; given Blaud's pills. July 4, brought in hammock to the hospital. Was very edematous. Given 3–10, with 0.02 podophyllin, as ova of uncinaria were found. Returned home several days later. July 24, specimen of feces brought by father who said that she was very ill with edema, great weakness, and some diarrhea. Blaud's pills were repeated. August 13, father brought card saying that she died on the 26th of July.

Cause of death: Chronic uncinariasis, extreme grade.

Case 606.—M. J. Admitted to hospital, May 22. Age, 13, male. Was brought in a hammock, moribund, semiconscious, and tremendously swollen. He presented symptoms of effusion of serum into the ventricles of the brain. Became unconscious, passing feces and urine involuntarily. A great many ova of uncinaria were found but no anthelmintic was given. Stimulants freely administered hypodermically. Died May 25, in a comatose state.

Cause of death: Edema of ventricles of brain, due to chronic uncinariasis, extreme grade.

Case 791.—P. R. Admitted to hospital, May 23. Age, 42; male. Marked case. Constant pain in stomach with vomiting of blood. Many ova of uncinaria. Given 3–30. June 1 still ova uncinaria; given 3–30. Died June 6.

Cause of death: Chronic uncinariasis, severe grade, and ulcer of stomach.

Case 895.—J. R. Admitted to clinic as out-patient, June 8. Age 14; female. Moderate anemia but was a severe case of acute phthisis, with sputum loaded with tubercle bacilli. Given 2–15. Never returned. Died about the middle of July.

Cause of death: Pulmonary tuberculosis.

Case 1329.—J. S. Admitted to clinic as out-patient, June 19. Age, 19; male; negro. Had a moderate grade of anemia but many ova of uncinaria. Given 4–30. Coming for his second visit, he fell into a stream, got very wet, and re-

turned home. As a result of this, contracted pneumonia, and was brought to hospital, June 27. Examination revealed consolidation of the greater part of the right lung. This extended to the other lung, and he died, July 1, in spite of appropriate treatment.

Cause of death: Double lobar pneumonia.

Case 1358.—F. R. Admitted to hospital, July 22. Age, 25; male. Many ova of uncinaria. Great anasarca; profound anemia; signs of compression of brain by effusion of fluid into ventricles. Died, July 24. No anthelmintic administered.

Cause of death: Edema of ventricles of brain due to chronic uncinariasis, extreme grade.

Case 1400.—J. R. C. Admitted to clinic as outpatient, June 20. Age, 25; male. Marked case. Many ova of uncinaria; given 4–30. Anemia became more profound, and he died, July 10.

Cause of death: Chronic uncinariasis, extreme grade.

Case 1443.—J. M. M. Admitted to clinic as outpatient, June 21. Age, 40; female. Very marked case; great many ova of uncinaria. Died, July 3.

Cause of death: Chronic uncinariasis, extreme grade.

Case 2231.—R. M. Admitted to clinic as outpatient, July 2. Very extreme case; many ova uncinaria. Given 2–10. Died, July 9.

Cause of death: Chronic uncinariasis, severe grade.

Case 2551.—F. P. Admitted to clinic as outpatient, July 6. Age, 20; male. A moderate case. Many ova uncinaria; given 3–20. July 13, still ova uncinaria; given 3–20, in hospital as boy said he had no home. He worked around the hospital grounds, seemingly improving steadily, but on July 20 he went to town and got hold of some spoiled jerked beef. That afternoon he was taken ill with ptomaine poisoning, and in spite of all measures taken, died the following day.

Cause of death: Ptomaine poisoning.

Case 3095.—M. R. Admitted, July 11. Very marked case with great anasarca. Given 4–25. Died at home, middle of July.

Cause of death: Chronic uncinariasis.

Case 3418.—M. S. A. Admitted, July 10. Age, 30; female. Very marked case. Hb. 15 per cent. Heart dilated. Tubercular cavities in both lungs. Strychnine and digitalin given hypodermically every 3 hours. July 12, 2–10 was given. On the 16th diarrhea supervened. On the 19th many ova of uncinaria were found. 2–20 was given with .02 podophyllin. She died, July 21.

Cause of death: Pulmonary tuberculosis. Contributing cause: Chronic uncinariasis, severe grade.

Case 4438.—V. R. Admitted, July 23. Very severe case. Great anasarca; great debility; profuse diarrhea. No anthelmintic administered, but stimulants and astringents given. Died, August 5.

Cause of death: Chronic uncinariasis, extreme grade.

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THE SECOND REPORT OF THE PORTO RICO ANEMIA COMMISSION.

LETTER OF TRANSMITTAL.

AIBONITO, P. R., *January 1, 1906.*

SIR: We have the honor to transmit herewith a preliminary report of the transactions of this commission from June 1 to November 30, 1905.

In it we have discussed, with as little technical phraseology as possible, the results obtained, our observations, and recommendations regarding Uncinariasis in Porto Rico. Although this report includes only our operations to November 30, the work at all stations has continued uninterruptedly, and we hope to be able to support them with the present appropriation until February 1, 1906.

It is the intention of this commission to publish at a later date a more complete report including the results of certain studies of purely scientific nature, observations drawn from work in the clinic, hospital, and laboratory.

Respectfully,

PEDRO GUTIERREZ IGARAVIDEZ, M. D.,
W. W. KING, M. D.,
Passed Assistant Surgeon,
U. S. Public Health and Marine-Hospital Service.
BAILEY K. ASHFORD, M. D.,
Captain, Assistant Surgeon, United States Army.

Hon. BEEKMAN WINTHROP,
Governor of Porto Rico.

AN ACT To continue the work of the commission for the suppression of anemia in Porto Rico, and making appropriation therefor.

Be it enacted by the Legislative Assembly of Porto Rico:

SECTION 1. The sum of fifteen thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, for the purpose of continuing the work of suppressing the disease known as uncinariasis in Porto Rico.

SEC. 2. The said appropriation shall be expended under the direction of the governor of Porto Rico for the necessary expenses of carrying on the work, establishing hospitals, purchasing medicines and supplies, and the employment of the necessary physicians, nurses, and other employees.

SEC. 3. The governor is hereby authorized, if he deems best, to use as a hospital either or both of the barracks constructed at Humacao and Jayuya for the convict labor on the road work.

SEC. 4. This act shall take effect from and after its passage.

Approved March 8, 1905.

THE ENTRANCE TO THE DISPENSARY, AIBONITO, 1905.

BRIEF ACCOUNT OF THE WORK OF THE COMMISSION.

The results of the work published as Report of the Commission for the Study and Treatment of "Anemia" in Porto Rico, dated December 1, 1904, were of such importance that the Legislative Assembly at its next session appropriated $15,000 to continue it, and the governor of Porto Rico reappointed the members of the former commission, forming what is known as the Porto Rico Anemia Commission.

As the commission had advised in its report two practical methods of attacking the disease, the question now confronting it was to put into actual practice the measures advocated. Estimates for an extensive campaign were made and orders were placed for medicines and supplies which, on account of the large quantities needed, had to be purchased from wholesale houses in the United States. In this there was also the advantage of obtaining goods at wholesale prices. In the meantime, plans were made for the organization of a central station and several substations, the number of which was not determined until we could begin operations and learn how much could be done with the amount at our disposal.

The commission desired to locate its headquarters in some place in the mountainous interior where the disease is most prevalent; central to a large territory to be covered by the various stations; on one of the main thoroughfares and with reasonable facilities for transportation; where the municipal authorities would lend their moral support; and where no work of this kind had been done, so that we could see what could be accomplished in an entirely new field. Aibonito was suggested as a suitable location, and during a visit of inspection a site for the station was selected, an unused road house on the military road some distance from the town. It was in need of extensive repairs and renovations, toward which the municipality of Aibonito offered to appropriate $100. The offer was accepted and the commission moved to Aibonito early in May to superintend the preliminary repairs and additions that were needed. These repairs, etc., were not completed until the second week in June, but were sufficiently advanced to allow us to open the outdoor clinic on June 1.

The hospital tents and equipment which had been stored in Utuado since the termination of the work of the previous year were transported to Aibonito and erected in the field immediately in the rear of the building occupied by the commission. They were arranged in a curved line following the crest of a sloping hill. In one corner of the field a camp kitchen was built, while two other corners were occupied by privies, one behind each end tent. The privies were constructed on approved sanitary lines, using the pail system. The slope of the hill made it convenient to remove the cans from the rear and rendered it unnecessary to dig any pits, the cans simply being placed on a cement floor to prevent contamination of the earth.

Patients first entered the examining room, where their feces were subjected to microscopic examination. If it was the first visit, the history of the case was entered on the clinical card bearing a serial number; a smaller identification card numbered to correspond was given to the patient to be presented on subsequent visits. By means of this smaller card their history could be easily found in the file,

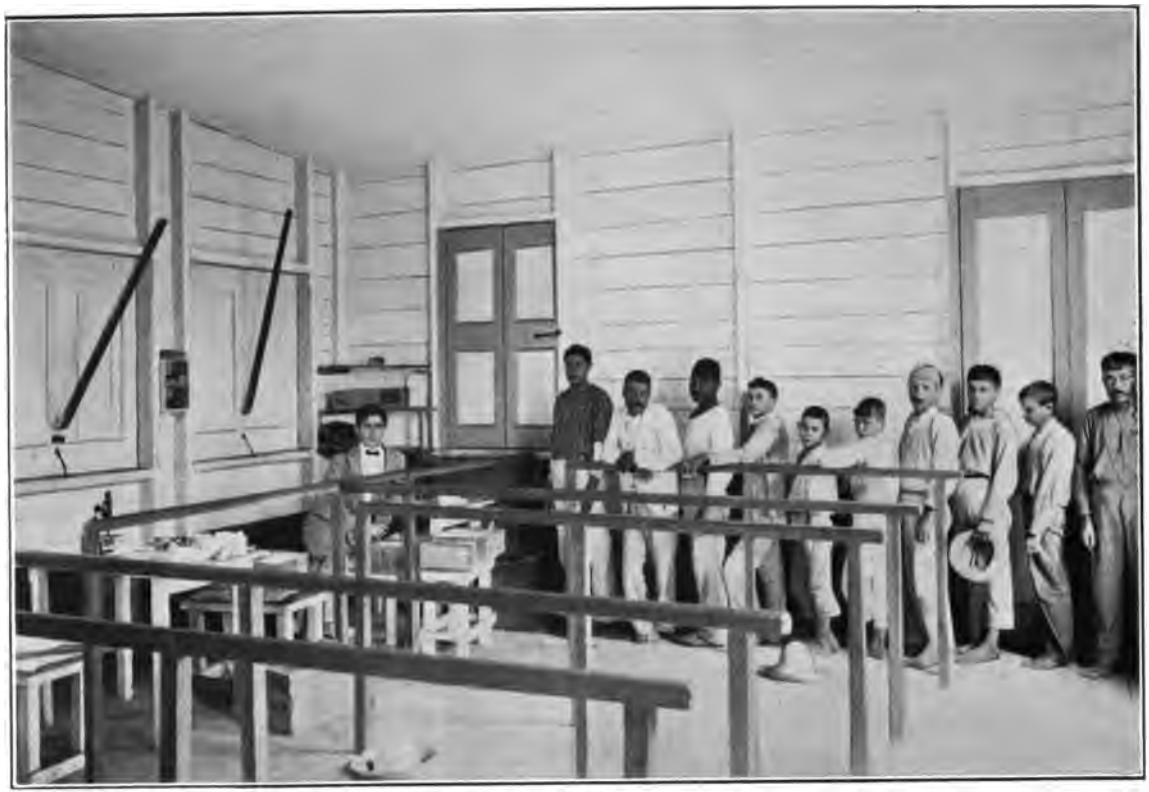
and notes as to condition, treatment, etc., added at each visit. To new patients a few plain words were said in explanation of their disease, how they contracted it, and how to prevent reinfection. Specimens of the parasite were shown them, and a small pamphlet containing the same explanations was given to those who could read or had anyone to read it to them. These pamphlets were also distributed throughout the district by the Insular police stationed at Aibonito when making their rounds through the country. Each patient was asked if he had a privy at his home, and in case of a negative answer, as nearly all were at first, he was enjoined to construct one immediately. It soon became common to hear new patients say that they had already complied with these instructions, having been told to do so by others who had been to the clinic. That the vast majority of our patients did obey, we have not only their own word but the evidence of plantation owners and others in the country, and more particularly the reports of Policeman Joaquin Sanchez, who was detailed for duty as inspector for the commission. His inspections covered every barrio of Aibonito and some of other municipalities from which we received a considerable number of patients. He made reports on the construction of privies, conditions in the barrios, assisted very ill patients to reach the hospital, and performed duties of similar nature. He appreciated the responsibilities of his work, as he himself had been a sufferer from a severe grade of the disease, and was cured by the commission during the previous year at Utuado.

Although no special announcement was made of the opening of the station, patients came in increasing numbers until the commission saw itself obliged to secure the services of Dr. E. Canino, of San Lorenzo, and Dr. Manuel Dueño, of Bayamon, as assistants to the commission. The latter resigned November 10.

The attendance of the patients on the clinic naturally fluctuated, but the majority of them came quite regularly at intervals of a week or two, according to the medicine they received. Those from a long distance were given sufficient for the longer interval. Saturday was always the busy day, the number of visits exceeding 500 on several occasions. The clinic was closed on Sundays, no out-patients being treated except sometimes one or two who had come a long distance in ignorance of this rule. The table of visits has been compiled by weeks, thus giving a good idea of the work of the station without the tediousness of a daily record with its unimportant variations.

The tent hospital of 60 beds was ready for occupancy by June 15. In it were placed patients suffering from severe grades of the disease, and some who, though not gravely ill, had come distances too great for them to return at intervals for the medicine. The hospital also afforded an opportunity to keep under observation cases presenting special symptoms or complications, and those on whom special investigations were being made, as the series of cases used to observe the effects of the anthelmintic drugs. From June 15 to November 30 205 patients were admitted for varying lengths of time, aggregating 7,137 days of hospital treatment.

As soon as the central station at Aibonito could be thoroughly organized and put in good running order we turned our attention to the establishment of substations at several towns which had requested our aid. The first was opened July 15, at Lares, under the charge of



THE CLINIC ROOM, AIBONITO, 1905.

A GROUP OF HOSPITAL PATIENTS, FIELD HOSPITAL, AIBONITO, 1905.

Dr. Francisco Sein, of that town, and from time to time others were opened as fast as arrangements could be made to do so. Even after we had placed in operation the six substations, all that we believed possible to maintain with our limited resources, various municipalities requested similar ones, but unfortunately we could do no more than offer the medicines. Indeed, San Sebastian asked for medicines alone. Under these conditions four additional substations, at San Sebastian, Barros, Moca, and Patillas, were established. The latter, however, was opened so late in November that practically no work was done in the time embraced by this report.

The physicians who were to take charge of the substations were invited to visit the central station at the expense of the appropriation to observe the methods of working, manner of keeping records, etc., thus insuring uniformity in the data obtained at the various stations. This system of substations was somewhat of an experiment, and its success has been one of the most gratifying results of the year's work. It proves the feasibility of establishing a number of stations in various parts of the island which will work in harmony under a central direction. We acknowledge with pleasure that the credit belongs more to the directors of these stations than to the commission, which exercised only an administrative function toward them. Their statistics have been tabulated with those of the central station for the purpose of showing the combined results of all stations.

The disease is one to which the white and mixed races are predisposed, having always in mind, however, the possibility of encountering serious symptoms in the infected negro. We were working in parts of the island where the negro is relatively rare, with exception of two substations.

Color of all patients in relation to the clinical type of uncinariasis.

Type of uncinariasis.	White.	Mulatto.	Negro.	Not recorded.	Total.
Very light	946	349	83	.....	1,378
Light	3,061	1,111	311	.....	4,483
Medium	7,135	1,343	228	.....	8,706
Intense	3,034	427	40	.....	3,501
Very intense	384	48	8	.....	440
Unclassified	101	62	12	182	357
Total	14,661	3,340	682	182	18,865

Relation between the color of all patients treated and the relative number of uncinaria ova found in their stools on microscopic examination.

Relative number ova uncinaria.	White.	Mulatto.	Negro.	Not recorded.	Total.
Great many	330	60	13	.....	403
Many	4,330	958	142	.....	5,430
Moderate	5,665	1,355	360	.....	7,380
Few	2,696	873	153	.....	3,722
Very few	198	43	5	.....	246
Unclassified	.....	.....	.....	173	173
Total	13,219	3,289	673	173	17,354
Plus substation, Barranquitas (no microscope)	.....	.....	.....	.....	1,425
Plus substation, Moca (no microscope)	.....	.....	.....	.....	86
Grand total	.....	.....	.....	.....	18,865

From the summary of Table 4 we see that 78+ per cent of 18,865 patients were white, 18+ per cent were mulattoes, and only 3+ per cent were negroes.

Of the total number of 14,560 whites treated, excluding those in which the type of the disease was not stated, 72+ per cent were medium, intense, or very intense cases, while only 41+ per cent of the 670 negro patients fall in this classification.

On the other hand, from the summary of Table 5 we find that the white patients in whom a moderate, large, or very large number of eggs of uncinaria were observed in the stools, form 78+ per cent of the 13,219 whites treated, and that 76+ per cent of the 673 negro patients fall in this classification.

In other words, the negro is just as heavily infected, just as dangerous to the community in which he lives, as the white man, but he possesses a relative immunity to the effects of the parasite.

The ages of our patients are graphically portrayed in the following summaries:

Relation between the ages of all patients treated and the clinical type of uncinariasis they presented.

Type of uncinariasis.	Years of age.								
	Less than 5.	5 to 9.	10 to 14.	15 to 29.	30 to 49.	50 to 59.	Over 60.	Not recorded.	Total.
Very light	28	216	371	489	220	39	13	2	1,378
Light	77	628	1,049	1,682	822	153	60	12	4,483
Medium	82	830	1,905	3,587	1,844	311	142	5	8,706
Intense	43	235	650	1,458	859	179	68	9	3,501
Very intense	4	30	63	179	112	30	21	1	440
Unclassified	6	20	25	74	34	9	6	183	357
Total	240	1,959	4,063	7,469	3,891	721	310	212	18,865

Relation between the ages of all patients treated and the relative number of uncinaria ova found in their stools on microscopic examination.

Relative number ova uncinaria.	Years of age.								
	Less than 5.	5 to 9.	10 to 14.	15 to 29.	30 to 49.	50 to 59.	Over 60.	Not recorded.	Total.
Very few	7	41	62	87	37	7	5	0	246
Few	61	487	762	1,516	715	124	49	8	3,722
Moderate	125	811	1,691	2,915	1,378	289	157	14	7,380
Many	33	425	1,104	2,222	1,335	239	65	7	5,430
Great many	1	20	93	146	111	22	9	1	403
Unclassified								173	173
Total	227	1,784	3,712	6,886	3,576	681	285	203	17,354
Plus substation Barranquitas (no microscope)									1,425
Plus substation Moca (no microscope)									86
Grand total									18,865

From this we see that 72+ per cent of all our patients were under 30 years of age.

Two facts should be borne in mind in the consideration of these last four tables:

1. The degree of the disease was estimated by the clinical signs and symptoms. Here in Aibonito, at least, cases classed as "medium" would be considered as severe in the United States and in Europe.

2. The same observation may be made with regard to the estimate made of the number of eggs of uncinaria per field of the microscope (No. 4 eyepiece and 3 objective, Leitz). "Moderate" signifies from two to five eggs per field.

The results of treatment are summarized from Tables 8 and 9 as follows:

Results of treatment of patients, classified according to the clinical type of uncinariasis presented.

Type.	Cured.	Under treatment.	Died.	Total.
Very light	518	860	.....	1,378
Light	1,449	3,033	[1] 1	4,483
Medium	2,747	5,949	10	8,706
Intense	1,091	2,382	28	3,501
Very intense	110	304	26	440
Unclassified	82	100	2	184
Not recorded	.....	.....	.....	173
Total	5,997	12,628	67	18,865

[1] Case 5,128 had a light grade of uncinariasis, but came to our clinic with advanced tuberculosis, from which he died.

At the close of the chapter devoted to the prevention of uncinariasis an explanation of the expression "under treatment" is made. Suffice it to say that fully 10,000 (estimated) of the 12,628 persons classed as under treatment are practically cured, which, with the 5,997, gives an estimate of 84+ per cent cured.

Our death rate has been extremely low, only ⅓+ per cent of the total number. Most of these deaths were due to other causes. A fair estimate of what has occurred at the various substations may be seen in the following table of deaths occurring among the 6,152 patients treated at the central station, Aibonito:

Deaths, central station, Aibonito.

Case.	Date of admission.	Date of death.	Municipality.	Cause.
18	June 2	July 14	Morovis	Chronic parenchymatous nephritis.
296	June 8	June 15	Aibonito	Chronic uncinariasis.
966	June 18	July 15	Barranquitas	Chronic enteritis.
1182	June 22	Oct. 18	Aibonito	Gangrene lower extremities, due to extreme œdema of uncinariasis.
1315	June 24	July 7	Barranquitas	Dilatation of heart due to uncinariasis.
1990	July 9	Oct. 19	Aibonito	Chronic nephritis.
2504	July 27	Aug. 4	Barranquitas	Pulmonary tuberculosis.
2606	July 28	Oct. 19	Aibonito	Chronic amœbic dysentery.
2668	July 29	Aug. 16	Barranquitas	Dilatation of heart due to uncinariasis.
3325	Aug. 18	Oct. 29	Coamo	Chronic dysentery.
4194	Sept. 9	Oct. 20	Cidra	Tuberculosis of the larynx.
4661	Sept. 20	Nov. 4	...do	Uncinariasis.
5128	Oct. 3	Oct. 30	Aibonito	Pulmonary tuberculosis.
5177	Oct. 1	...do	Cayey	Uncinariasis.

All deaths whose cause is noted as due to diseases other than uncinariasis, save case 5128, were complicated by an intense or very intense grade of uncinariasis.

The following is a summary of the number of doses of anthelmintic administered and the number of times each case received the drug:

Results of treatment of patients, classified according to the number of doses of the anthelmintic administered.

Doses anthelmintic.	Cured.	Under treatment.	Died.	Total.
One	17	2,182	21	2,220
Two	195	2,554	20	2,769
Three	981	1,741	14	2,736
Four	1,085	1,701	7	2,793
Five	882	974	4	1,860
Six	651	1,102	.....	1,753
Seven	509	601	.....	1,110
Eight	459	549	.....	1,008
Nine	352	334	.....	686
Ten	271	329	1	601
Eleven	191	186	.....	377
Twelve	145	153	.....	298
Thirteen	94	63	.....	157
Fourteen	61	60	.....	121
Fifteen	34	31	.....	65
Sixteen	35	20	.....	55
Seventeen	17	17	.....	34
Eighteen	7	11	.....	18
Nineteen	6	8	.....	14
Twenty	4	2	.....	6
Twenty-one	.....	2	.....	2
Twenty-two	.....	1	.....	1
Twenty-three	1	2	.....	3
Twenty-five	.....	1	.....	1
Not stated	.....	2	.....	2
Unclassified	.....	.....	.....	175
Total	5,997	12,626	67	18,865

Grand total doses of anthelmintic, 89,908.

Total number of patients from each of the municipalities reached by the combined work of all stations.

Municipality of—		Municipality of—	
Aibonito	3,774	Fajardo	1
Barranquitas	1,868	Ciales	19
Barros	1,550	San Juan	2
Comerio	1,644	Arecibo	67
Coamo	1,531	Juana Diaz	7
Utuado	2,058	Santa Isabel	8
Guayama	623	Bayamon	18
San Sebastian	746	Ponce	3
Moca	86	San Lorenzo	2
Lares	3,457	Patillas	104
Cidra	694	Arroyo	8
Cayey	190	Hatillo	27
Morovis	81	Adjuntas	94
Caguas	5	Las Marias	14
Naranjito	122	Camuy	6
Aguas Buenas	26		
Salinas	13	Total	18,865
Corozal	17		

A consideration of this summary permits the following deductions to be drawn:

1. In those municipalities possessing a station of the commission (first 10 of the summary) the work of treating infected persons has

been actively prosecuted. In most of them the prophylactic value of this work is enormous, as seen from the large numbers treated.

2. In others, such as Cidra, the campaign has reached such proportions that it offers every assurance of a like result.

3. In all others, generally far from the stations, the value of the work is being made the subject of general conversation among the laboring classes, due to the cures effected in individuals from such municipalities who sought treatment. It may be confidently expected, when a number of persons from them has been cured, that all these municipalities will begin to demand a station of their own, so overwhelming is the propaganda made by those who have the evidence of their personal experience to lead them to speak.

Number of visits made by patients to the central station at Aibonito, arranged according to the municipality from which they proceeded.

Municipality.	Number of visits.	Municipality.	Number of visits.
Aibonito	16,095	Salinas	26
Barranquitas	2,207	Corozal	11
Barros	879	Utuado	5
Comerio	603	San Juan	6
Coamo	1,935	Arecibo	1
Cayey	522	Juana Diaz	9
Cidra	2,271	Fajardo	2
Morovis	2	Ciales	1
Caguas	6	Santa Isabel	6
Naranjito	25		
Aguas Buenas	16	Total	24,628

This summary shows how relatively little the distance operates to deter the jibaro from pursuing a treatment once begun.

Total number of visits made by patients to the various stations.

Stations.	Patients beginning treatment.	Patients returning for treatment.	Total visits.
Aibonito	6,152	18,476	24,628
Barranquitas	1,425	6,113	7,538
Barros	1,255	5,536	6,791
Coamo	1,048	4,730	5,778
Comerio	1,676	7,830	9,506
Guayama	746	1,223	1,969
San Sebastian	663	1,419	2,082
Moca	86	105	191
Utuado	1,813	3,841	5,654
Lares	4,001	8,272	12,273
Total	18,865	57,545	76,410
Persons in whose feces no eggs of uncinaria were found. This data only recorded in Central Station			486
Total			76,896

This enormous number of visits, in each of which personal cognizance of the patient's condition and progress was taken, a microscopic examination of his feces made, and an appropriate prescription written and dispatched, record being made on the history card kept on file, as before described, demonstrates what an immense work it is possible to accomplish, proceeding along the lines laid down by the commission for the present year and recommended on a larger scale for the future.

It has been said that the jibaro seeks novelty and the air of mystery pervading a clinical laboratory, in which many strange instruments are grouped about the patient, and many examinations of his blood, feces, etc., are made. While not discounting the human trait that may be attributed to all people under such circumstances, the commission is persuaded that the jibaro is not actuated to any great extent by such motive in his long tramp from some distant mountain barrio. It is his health he seeks. When we began to receive patients at the station in Aibonito, and for at least two months thereafter, no other station existed within reach of the people of Barranquitas, Barros, Comerio, Cidra, and Cayey. An ever increasing number from these municipalities swelled our clinic.

In August we established substations in Barranquitas, Comerio, and Barros. At these stations no laboratory, properly speaking, existed—only the excellent doctors who took up the work at those places, and the neat little offices fitted up by their own personal efforts, forwarded by the enthusiastic municipal authorities. At once our patients from those municipalities began to fall away from the central station. They knew that the same treatment was being employed at these points; they were kindly received there, and their chief object—to get cured—was satisfied. In the meantime the number from Cayey, and especially from Cidra, where no stations could be established, kept steadily increasing, although both are far distant and consume at least an entire day in the trip to Aibonito.

So we see that it is the opportunity to regain their health that attracts them—not novelty.

The effects produced by the drugs thymol and beta-naphthol have been carefully studied by the commission. Their relative value is discussed in the chapter on prophylaxis. Both are excellent in their results, and each has special uses, which, together with the compilation of our data on this subject, will be fully discussed in a future report. Suffice it to say that the repeated use of these anthelmintics weekly for two or three months in cases which have suffered from intense anemia is not advised. Beta-naphthol in such cases may, by adding the element of irritation to a kidney already profoundly diseased, aggravate the existing process. This is by no means believed to be a contraindication to its general use, but it should be considered in a small proportion of cases. Thymol is far less irritating, and our belief is that five consecutive doses of either is sufficient, usually, to bring the patient, if not to a technical cure, at least to the assurance of a practical cure. After this he can be instructed to return for further treatment at the end of a month, when, if need be, the vermifuge may be repeated.

Thus we see that the specific treatment of "Porto Rican anemia" is a fact established beyond all quibble or question. The long list of "sure-cure" patent iron pills, powders, and blood and nerve restorers, so dearly paid for by the unfortunate and credulous "jibaro," paid for, it should be remembered, from the earnings of a class said to be starving in poverty, is a list too long and too disgusting to contemplate without anger and a sense of shame. Its length is sufficient guaranty of the utter inefficacy of any one of such preparations to cure, for had any particular one of the marvelous fabrications been true all others would have sunk into oblivion. As it is, all have prospered, enriched by the sweat of thousands who spend an immense

quota of their savings to reap a bitter disappointment in broken promises of health and vigor. We believe that no more startling instance of the pernicious custom of trusting to patent medicines exists than in the exceedingly interesting history of the recovery in Porto Rico by scientific medicine—by the doctor—of a territory exploited by commercialism, the innocent faith of the poor "jibaro."

In regard to iron and all iron preparations, let it be said that the commission has well-nigh abandoned its use, even in the presence of 8 per cent Hb. Many of our directors are coming to adopt the same position, and, as the work goes on, as they become familiar with the relatively small value of iron, they are gradually dropping its use, where previously it was, as it was with us, a sine qua non in the treatment of uncinarial anemia following specific medication.

The subject is referred to and emphasized because the eager throng of vendors of patent ferruginous tonics is pressing in to recommend their preparations, basing their supposed value upon a previous report of this commission, on which no very different construction can be placed from that just expressed.

We do know the relative value of iron in uncinariasis. It is of some value, but its value is the same in the aftertreatment of this disease as in the treatment of malaria or syphilis.

Lack of space forbids us to acknowledge individually the services and moral support of the thousands of friends of this work. Besides those whose active part has contributed so much to its success, we desire to express our deep appreciation of valuable services rendered the commission by the pharmacist of Aibonito, Licenciado Señor Don Teodoro Moscoso. Fully one-half of this pharmacist's income came from patented blood restorers. When he saw the results of anthemintic treatment he refused to sell them to anemics until they had sought our clinic.

THE PREVENTION OF UNCINARIASIS IN PORTO RICO.

HOW DOES INFECTION TAKE PLACE.

The commission, as a result of its two years of investigation, has come to the conclusion that, if not in all, at least in 99 per cent of all those who harbor uncinaria in their intestinal canal, the parasite effected its entrance into the body through penetration of the skin in contact with soil or water loaded with the young larvæ. In other words, we now know that the barefooted laborer in infected soil who contracts the characteristic "ground itch" or "mazamorra," so familiar to every shoeless individual on the island, is invaded by uncinaria.

In brief, the sequence of events is as follows: The parasite lives in the intestine of man. An ordinary case of uncinariasis, such as we see so frequently here, produces over a million eggs a day, which are laid by the female worms in the upper part of the small intestine and become well mixed with the feces. These feces, deposited under proper conditions of shade, moisture, and temperature, always to be found in Porto Rico, give rise, upon the hatching of the eggs, to innumerable, minute young worms, the larvæ, which await the opportunity to penetrate the skin of man and travel to his intestine, their final and natural home. Very fortunately, these larvæ can

not reproduce their species outside of the human body, nor do they live indefinitely in the earth, although we have not yet been able to define their limit of natural existence. When one harbors but few worms, the symptoms of infection are usually few or absent entirely and the individual is much less dangerous to the community in which he lives than he who is sick or ailing from a large number.

Mazamorra is the first sign of infection by uncinaria, and if severe or repeated attacks take place uncinariasis will follow.

Uncinariasis is that condition resulting from infection by uncinaria in sufficiently large numbers to overcome a man's resistance to the poison elaborated by the parasite resident in the intestinal canal, a poison whose effect is manifested by certain notable disturbances in the functions of vital organs. While frequently the symptoms are confined to a general reduction in strength, dizziness, and vague pains in chest and stomach, without noticeable pallor, it is only too common to observe a more or less grave alteration of the blood, resulting in that symptom of advanced uncinariasis which the layman has so much reason to fear and respect from years of dread experience, anemia.

This is the lamentable condition which some continental newspapers have been pleased to call "the lazy disease."

Thus we know that the long-time curse of Porto Rico, its anemia, is a disease, not an expression of an insufficient or improper diet, no matter how evident the poverty and wretchedness of thousands of poor on this island. With regard to the latter, we as medical men may deplore but can not help such conditions wherever they may exist. With the former only physicians and sanitarians can successfully deal.

Therefore, whether very ill or apparently well, everyone infected by uncinariæ is a menace to the public health, for, if he defecates upon the earth where others must tread he stocks it with a numerous progeny, which, maturing, will seek another human host, perhaps one of his own family.

As evidence in part for our decided views with regard to skin infection, we refer to the fact that only 4+per cent of all whom we found infected denied having had mazamorra. Even among this small number of persons many will be found who either forgot that they had had it or who did not care to mention it for fear of humiliation. The correctness of both of these suppositions we have had ample opportunity to prove. Moreover, in 486 persons who presented themselves for treatment in Aibonito and in whom neither eggs of uncinaria were found nor anemia present, only 234 stated that they had had mazamorra and generally such persons had suffered from it at a period so remote that all worms had long ago come to the end of their natural existence, or, in other words, had died of old age.

All other routes of infection are rarities, at least in Porto Rico, and do not merit the space necessary to discuss them.

WHERE DOES INFECTION TAKE PLACE.

The conclusions of the commission are based upon two facts:

1. Earth soiling is commonest in Porto Rico around the house, in the bushes, or in the dense shade of banana plants which shelter so many huts. Exposed places are not sought for the accomplishment of this act but rather a secluded spot. The jíbaro goes to "el monte,"

"the bushes." As these huts in the interior are very frequently on the edge, or in the midst of a coffee plantation, it thus comes about that the latter contains many true foci of infection. Not only this, but apart from earth soiling near the house, we must consider the general pollution of the plantation by the laborer who is interrupted while at work by a desire to evacuate his bowels.

2. (*a*) In order to ripen to the larval stage the egg must be deposited under proper conditions of shade and moisture. In order that the life of the larva be preserved, drying must be avoided. The egg is far less resistant to this influence than the fully developed larva.

(*b*) All decomposing vegetation, especially the detritus from the banana plant, forms a perfect medium for the protection of the young parasite.

Our conclusion is that the coffee plantation of Porto Rico offers the most perfect conditions for the development of the larva from the egg and for its preservation thereafter.

Total number patients classified according to the usual localities where their mazamorra was contracted.

Coffee plantations	11,660
Coffee plantations and surroundings of the home	1,099
Surroundings of the home only	461
Open country	977
Roads and paths	2,201
Rivers, streams, and pools of water	165
Town streets	161
Stables and corrals	703
Tobacco plantations	19
Banana patches	161
Sweet potato patches	2
Surroundings of public schools	17
Sugar plantations	28
Not classified	420
Persons with ova of uncinaria in their stools who deny having suffered from mazamorra	791
Total	18,865

The question, "Where do you generally get mazamorra?" was answered by 67+per cent, "In the finca." As we were working in the interior, this generally meant, "finca de café" (coffee plantation).

When one stated that he had received his infection from the surroundings of his home, he generally meant its immediate proximity; not from the shade of near-by bushes, but from the patio, or yard, shaded by the house or trees.

All other localities mentioned always refer to damp places infected by human feces; spots which the sun fails to thoroughly dry. Mere sunlight does not usually kill the larvæ; however, it may retard their growth. Drying must be effected to destroy them.

Infection in rivers and streams occurs from mud at the edges of such streams, not from the flowing water. Many washerwomen and water carriers thus contract uncinariasis.

Tobacco plantations and sugar plantations are not such dangerous sources of infection, save in certain spots not open to the influence of continuous sunlight or localities containing at all times a sufficient amount of water, such as ditches for irrigating purposes, simply because such spots are few and far between, although they form ideal culture grounds for the larvæ.

Thus, in all parts of the island where coffee is not the chief product, as on the coast, infection is generally derived from the bushes in the vicinity of the home.

The foregoing reflections are merely very general.

While it is a fact that the commission plainly sees that coffee plantations will always be the chief sources of mazamorra for the people of the interior, and we include the surroundings of the home as part of such plantation in the vast majority of instances, as Table 10 shows, almost no place is exempt from contamination, because when night falls to screen his act, the countrymen soils anywhere it may be convenient for him to do so.

In the period of the annual rains, not only are the infective larvæ widely scattered, but this is precisely the season when work goes on in the coffee plantation. Coffee picking usually begins and ends at the time of torrential rains. This is not generally a continuous rain, but an almost daily soaking of the earth. At such a time the plantations in the shade of a heavy vegetation never dry. Barefooted workmen, men, women, and children, swarm to secure the benefits of about the only regular employment they can count upon during the whole year. The little nicknacks and innocent pleasures of the elaborate Spanish Christmas festival, not to speak of the supply of clothing necessary for the ensuing year, all depend upon reaping the small annual stipend allotted the pickers for this two or three months work.

Thus the time of coffee picking is for tens of thousands the only fixed revenue of the entire year, and with all the eagerness with which they have flocked to our station for the cure of their terrible disease, they have temporarily, to a great extent at least, abandoned their cure to seek this pittance that they may be enabled to spend a "Merry Christmas."

Pitiful as it may be, it is a stern truth that thousands have thus gone to their death. Many times have we heard, in answer to the question, "Where did you get your mazamorra"? "During last year's coffee picking." Here in a pouring rain they work, picking coffee and sowing disease and misery for the annual harvest of lives, as portrayed by the island health reports in the usual 5,000 to 7,000 deaths a year from anemia.

As generally the laboring man and his family in the country go barefooted, in the rainy season mazamorra may be contracted almost anywhere, so that multiple infections generally bring about uncinariasis, and any large increment of parasites may carry off the already half-sick "jibaro."

The anemia of Porto Rico is a disease, it is an infectious disease, not an inherent condition, not an exhaustion of vital forces, not the natural end of man's existence here in Porto Rico. It cuts down man, woman, and child of every age. It cripples industrial effort, limits mental expansion, weakens the body, and depresses the spirit, until many laborers in a country where agriculture is the chief source of revenue are enervated, despondent, without hope of betterment, and without the power to save themselves. Sometimes a man can not earn enough to feed his family, and he is driven to eat the crudest gifts of a bountiful nature in the wild fruits of Porto Rico.

We are now speaking of the great mass of the people, numerically considered, the very heart's blood of the country, a blood which, on an average, is below 50 per cent of what it should and can be.

Methods to be employed in a campaign against the anemia of Porto Rico.—After many and serious discussions the commission has taken a final and determined position in regard to all future efforts to withstand this epidemic.

We believe that in the universal treatment of persons affected lies the secret of successful opposition to uncinariasis.

In this belief we are supported by the best medical opinion of the island, and by the principles adopted by England, Germany, France, and Belgium in combating the same disease in their mines. Whatever other measures may be taken, and many more are both advisable and necessary, the unit of prophylaxis should be the dispensary and hospital. Here we not only cure our sick, but we render innocuous the feces of thousands who will continue to pollute the soil in spite of prayers, lectures, advice, coaxing, and even the prohibition imposed by the law. At the station for treatment and prevention, which will be the place of places to teach the voluntary seeker after health why he is sick and how to avoid a repetition of his illness, a triple purpose is served—the man is cured and warned at the same time that he is rendered at least relatively incapable of spreading his diesase. That all these ends can be attained is evident from our practical experience in Aibonito and that of the directors of substations elsewhere.

Every person who seeks treatment at this station first receives a microscopic examination of his feces. If eggs of uncinaria are present he receives one of the specific vermifuges to take at home. Then he is well talked to, kindly advised, shown the parasites which cause his illness, how they bring about the condition of which he complains, and how he may protect himself from future attacks. He is told to return weekly with a small specimen of his feces until all eggs of the parasite disappear and he is pronounced cured.

The results of the six months' work ending December 1, 1905, have already been referred to. This vast number of persons who in that brief space of time applied for treatment is more eloquent than words. It is the mute appeal of the "jibaro" for aid, and it is directed to his more fortunate countrymen who run very little risk of contracting his disease and who receive, at least indirectly, the benefit of his labors. We can not believe that in the face of these facts, with a total of 18,798 persons cured or under treatment, and all this in so short a period, there can be any doubt as to the necessity for continuance of the work. In Aibonito, where about one-half of the entire population of the municipality have been under treatment, it is said that this year mazamorra is less than it was last year. Coffee pickers make this assertion. We have not been able to prove it, but it is certainly true of some plantations.

We have already spoken of the result of our direct preaching to the "jibaro" at the central station.

Not only does he fear to be without a privy for the fine or imprisonment imposed, but he fears, more than all besides, the disease from which he has just been liberated. It is only just to say that the character of the man we wish to help is such that when once convinced he is very tolerant of reform in his behalf. But he needs

the moral effect of inspection and law. He is accustomed to be told what to do and he awaits the order. In spite of this nothing will secure obedience to a sanitary law in which he can see no reason. And knowledge comes from seeing results, from practical demonstrations such as a station for the general treatment of infected and sick has given and will give.

It is futile to think of reaching him by pamphlets. This should be reserved for the plantation owners. He must be reached by word of mouth and the demonstration of the truth. To this end we would advocate inspectors, chosen from among those in whom these country people have confidence, some person of superior knowledge, but who is one of them, who speaks their tongue, lives their life, and whose processes of thought are theirs.

Such a person going about from house to house will preach the gospel of sanitary reform in a manner such as could never be accomplished by a prohibitory measure. He will accentuate to each one the truth of what may have been taught at the station. He will convey the very sick to where they can be properly treated, and he will discover recalcitrants of whom the law should make an example.

In order to complement the efforts of the physician and the admonishments of the law, we believe that all proprietors of plantations, especially those of coffee, should require their laborers to defecate in sanitary trenches, or even pits near the place of work, the digging and care of which should be under the surveillance of some special person.

The wearing of shoes should be universally counseled in the schools and wherever the vast opportunities offered by conversation between employee and employer can be seized. In our last report this was not mentioned, not because we were unaware of the importance of so self-evident a preventive measure, but because we believed it premature to advise. At the dawn of a general attack on the disease, with the execution of the plan within recommended, all measures of value should be pushed to their fullest extent.

Such a campaign will make the law something more than a dead letter and gives ample opportunity to all to comply with and understand the spirit of that law.

At the close of our remarks on the prevention of uncinariasis, the commission desires to make clear what we believe is a completely new phase of the fight against the disease.

Early in our labors we saw the necessity for ascertaining the relative value of the drugs heretofore advised for the expulsion of uncinariæ. In brief, for determining the actual number expelled by each successive dose of the anthelmintic employed.

The following table shows the result of this investigation:

Number of uncinariæ expelled by successive doses of the anthelmintic.

THYMOL.

Case number.	First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Total.
3934	670	372	46	15	7					1,110
3784	660	169	47	5						881
4286	1,149	10		1						1,160
3622	1,307	19	24	2						1,352
3291	285	36	1	4						326
3526	93	205	85	31	10					424
5022	818	17	12							847
6032	309	25	2							336
6049	182	51	3							236
5990	481	216	12	7						716
5124	541	57	23	2						623
4574	1,070	61		2	3					1,136
3203	358	90	41		1					490
3722	1,273	83	11							1,367
4290	1,237	77	26	13	3	4	1			1,361
5188	3,101	203	183	6						3,493
5291	287	36	4							327
5287	1,223	492	230	11	20	3				1,979
5158	49	775	119	99	13	2	17	3		1,077
6058	574									574
6067	77	19								96
5737	887	21								908
3921	1,404	517	96	36	18	2				2,073
5333	884	58	17							959
5545	1,610	252	8	1						1,871
5363	489	111	287	215	18	2				1,122
5508	704	286	8	7	2					1,007
5509	1,068	866	40	36	2	3				2,015
5550	281	142	25	7	5	5				465
5642	236	107	105	72	22	2				544
3985	215	212	62	41	21					551
5772	1,215	150	19							1,384
4626	234	15								249
	918	174	44	12						1,148
4766	1,321	108	17							1,446
4287	919	185	15	3						1,122
5991	3,686	480	218	11						4,395
4505	719	83	346	19						1,167
5257	2,264	39	13							2,316
6077	114	245	156	29	189	43				776
Total	34,912	7,064	2,345	687	334	66	18	3		45,429

Average percentage expelled after—

One dose	76.84+
Two doses	92.39+
Three doses	97.56+
Four doses	99.07+
Five doses	99.80+

Number of uncinariæ expelled by successive doses of the anthelmintic—Contd.

BETA-NAPHTHOL.

Case No.	First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Total.
3476	591	7	3	49						650
5434	305	414	130	15						864
3204	1,569	106	36	8	8					1,727
4243	242	3	1	1						247
4241	675	5								680
4933	469	32	18	11		12				542
5655	788	273	67	29	80	5				1,242
5676	387	19								406
5807	325	128	1	14	17	12				497
6089	312	9	12							333
5944	626	9	19							654
3475	804	379	279	66	38					1,566
3605	978	258	26	56	65	4				1,387
5808	96	9	7	3						115
4647	386	54	89	11	2					542
5537	693	108	182	37	68	22	25	60		1,195
3783	63	10								73
3190	503	235	92	113	43	5	4			995
3356	2,372	307	28	17						2,724
3206	2,007	201	15	2	8	1				2,234
5533	708	233	5							946
4934	339	2	8	2	1					352
5826	94	58								152
5626	662	62	2							726
5609	178	372	100	185	185	12				1,032
5809	97	9	2	18	4	15	14			159
4197	1,587	141	22	18	10					1,778
5802	432	495	233	76	70	10				1,316
5237	725	166	76	12		117	12			1,108
5848	115	103	17							235
Total	19,128	4,207	1,470	743	599	215	55	60		26,477

Average percentage expelled after—

One dose	72.24+
Two doses	88.13+
Three doses	93.68+
Four doses	96.49+
Five doses	98.75+

These tables only contain data obtained from the use of thymol and beta-naphthol, and in explanation of the reason why male fern was not the subject of a like investigation, it should be said that the attempt was made. An ethereal extract of male fern from one of the most reputable German pharmaceutical laboratories was purchased in Porto Rico. Practically no uncinaria were expelled by it and we were compelled to abandon its use, believing that it had possibly deteriorated from climatic influences, to which it is said to be very susceptible. A fresh solid extract was then obtained from one of the best American pharmaceutical houses. It gave no better results, although such effects as dizziness, etc., followed its administration. The highest number of uncinariæ expelled by either of these preparations was 8, while a subsequent administration of only three-fourths of the usual dose of thymol brought away 3,686, and this in the very same case (!). So much time had been wasted in these unfruitful trials that had we again ordered other preparations of the drug we could not have completed a series of cases with it.

Thymol was administered to 40 hospital cases at intervals of one week. All feces evacuated during 24 hours from the time of receiving the anthelmintic were saved, washed on filters of gauze by specially trained employees of the commission, and the residue placed in a 10 per cent formalin solution. From this residue the uncinariæ were recovered by steel forceps and counted by us.

Beta-naphthol was administered to 30 hospital cases under like conditions.

The finding of the commission is that after 1 dose of thymol, 76.85 per cent of all uncinaria in the intestinal canal of the patient are expelled; after 1 dose of beta-naphthol, 72.24 per cent; after 2 doses of thymol, 92.39+ per cent of the total number were expelled; after 2 doses of beta-naphthol, 88.13 per cent; after 3 doses of thymol, 97.56+ per cent of the total number were expelled; after 3 doses of beta-naphthol, 93.68 per cent; after 4 doses of thymol, 99.07+ per cent of the total number were expelled; after 4 doses of beta-naphthol, 96.49 per cent.

The remarkable results of the first doses, entirely unknown to the commission until we made these very important and disagreeable investigations, have come to modify not only our treatment but our prophylaxis.

For a long time the commission has been seeing cases clinically cured of the anemia after one or two doses of medicine. Especially is thus true of very light, light, and medium cases. Nevertheless, it was found that they still had some eggs of uncinaria in their stools. We now understand well, for the first time, the significance of this phenomenon and why such cases often fail to return. It is because they feel well and do not see the necessity for further medication. When a patient has been relieved of three-fourths to nineteen-twentieths of the parasites which caused his illness and the few remaining can not reproduce in the intestinal canal (a well-known fact), he either loses all of his symptoms or the major part of them.

Therefore, what we have considered a "cure" has been a techincal, a scientific cure. The 5,997 cases counted as cured fall under this category, but fully 10,000 of the 12,628, classed as under treatment are really freed of their anemia and other symptoms and are following the ordinary avocations of their life without the disease, which previously was more or less an obstacle to their work. They are classed as "under treatment," either because they still carried in their intestinal canal a few uncinaria or because they have failed to return that we may verify by the absence of eggs of the parasite from their stools their technical cure. In other words, they are "cured," as far as evidence of disease is concerned.

Looking at the matter from another point of view, namely, the infectiousness of such persons not completely and technically cured, as defined above, we find by calculation that we have been able to reduce about 94.5 per cent the power of spreading the disease, the power of infecting the earth, in the 18,865 cases treated, and that the 12,628 cases reported as still under treatment are only about 8.5 per cent so dangerous as carriers of the worm and sources of infection as they were before.

These facts lead to most valuable conclusions:

1. In general terms, five doses of thymol are sufficient to practically cure a patient suffering from uncinariasis. Exceptionally, more than five may be needed, and less than five may often be sufficient.

2. This number of doses generally reduces the danger of a patient to the community, in regard to his power to infect the soil, about nineteen-twentieths.

3. In the treatment of outpatients, beta-naphthol is decidedly inferior to thymol. In the hospital all cases who receive any anthel-

mintic are prepared for 24 hours before by a strict milk diet. Thus the vermifuge falls upon the parasites, unprotected by the mechanical covering offered by a full or partially filled intestine, and the results are not very different in one or the other drug; but in prescribing anthelmintics to patients who are to take their medicine at home, in spite of our directions, these dietary instructions are not always obeyed. Under such circumstances thymol is far more efficient than beta-naphthol, in that, by the use of the former, the eggs disappear from the stools with fewer doses and the patient recovers more rapidly.

RECOMMENDATIONS.

Reasoning from what has been accomplished, we recommend that the present system of central station and substation be continued and further amplified, so that the opportunity to receive specific treatment will be placed within reach of practically every anemic in Porto Rico.

We advise that this work be directed by a commission appointed by and responsible to the governor of Porto Rico for its faithful and economic administration. This commission should at all times be in touch with the governor, rendering regular reports of its operations and consulting him before making any extraordinary or unusual expense or change of plans.

The commission would formulate the necessary regulations for the proper organization and administration of stations and substations, and should see that such regulations were carried out. It would investigate the conditions in regard to this disease in Porto Rico, select the locations for stations, substations, and dispensaries, make agreements with the various municipal authorities for their assistance, and establish the stations when these agreements are fulfilled. It would also continue the medical investigation and study of the disease.

We advise the establishment of seven central stations located at convenient points so that each will dominate a large district and form for it the administrative center and distributing depot for medicines and other supplies; each central station to be in charge of a physician, who would have direction of all work in his district, responsible to the commission for all operations throughout all territory that may be confided to him, making monthly reports to the commission.

Tributary to the central station, there should be one or more substations and two or more dispensaries located in the smaller towns, as the necessities of the district may require.

The physicians in charge of these would be responsible to the director of their central station, making weekly reports of their operations. We estimate that 10 substations and 20 dispensaries will be needed throughout the entire island.

A central station should have a dispensary of at least four rooms, viz, examining room, dispensing room, storeroom, and office. It should be equipped with two microscopes with necessary accessories for examining patients, utensils for preparing and dispensing medicines, and such furniture as may be desired. In connection with this dispensary, there should be a hospital of at least 20 beds with equipment complete for the treatment of very grave or special cases. It

should be incumbent upon the city in which this station may be located to provide the building and ordinary furniture, as chairs, tables, etc., for the dispensary, and building and equipment, as beds, bed clothing, cooking utensils, furniture, etc., for the hospital. The commission should supply medicines, instruments, special equipment, and bear the expenses of personnel and maintenance of dispensary and hospital.

The personnel of a central station should be:

	Annually.
Director	$1,800
Assistant	1,000
Practicante	360
Scavenger	150
2 nurses	120
Cook	72
Peon	60
Total	3,562

The other expenses, exclusive of medicines, transportation, etc., are estimated as follows:

	Annually.
Installation and preservation	$120
Subsistence, with the ration at 15 cents	1,000
Microscopes and clinical accessories	200
Miscellaneous supplies	150
Total	1,470

Each substation should have a dispensary on somewhat smaller scale than that of a central station and hospital accommodations for 10 beds, the town in which it may be located providing assistance in the same manner as in the case of a central station.

The personnel of a substation should be:

	Annually.
Physician	$1,000
Practicante	300
Nurse	72
Scavenger and peon	72
Cook	60
Female nurse and laundress	60
Total	1,564

Estimating the other expenses at one-half of those of the same class at central stations, the annual cost would be $735 per substation.

The dispensaries would be on a still smaller scale than the substations, without hospital accommodations. The town should assist in the same proportion as at the larger stations.

The personnel of a dispensary should be:

	Annually.
Physician	$600
Practicante	180
Peon	60
Total	840

As the work at a dispensary would not be sufficient to occupy a physician's entire time nor justify compensation accordingly, as in the case at the larger stations, there would be no objection to the physician serving as health officer at the same time.

Other expenses are estimated for a dispensary:

	Annually.
Installation, etc	$25
Microscope and supplies	60
Miscellaneous	25
Total	110

The general expenses may be classified and estimated as follows:

	Annually.
Personnel of commission	$8,200
Medicines	10,000
Transportation	2,000
Printing, stationery, and office supplies	1,000
Travel	750
Laboratory	1,000
Postage and telegraphing	200
Miscellaneous	616
Total	23,766

We recommend that a sanitary inspector be attached to each central station, who would make periodical trips through the district to advise, persuade, and explain to the people the necessity for the construction of privies and the prevention of earth soiling. He would inform the director to what extent patients carried out the advice given them at the clinics, and report any cases of persistent and willful neglect of these simple sanitary rules. He would also look up patients who failed to return, and assist very ill patients to go to the station when they could not do so of their own resources. For the seven inspectors the cost is estimated to be:

	Annually.
Salaries	$2,520
Horses	350
Care of horses	420
Total	3,290

At one central station, the commission would have its headquarters, general depot of supplies, and a small clinical laboratory. At that station the commission would take direct charge of the work of that district in place of the director and assistant. A clerk should be employed to keep records and accounts, attend to correspondence and many small administrative details.

To recapitulate, we estimate the cost for a full year's work as outlined to be as follows:

	Annually.
One central station, substituting the commission and clerk for director and assistant	$8,962
Six central stations	30,192
Ten substations	22,990
Twenty dispensaries	19,000
Medicines	10,000
Transportation	2,000
Printing, stationery, and office supplies	1,000
Sanitary inspectors	3,290
Laboratory	1,000
Travel	750
Postage and telegraphing	200
Miscellaneous	616
Total	100,000

As already stated, this amount is estimated as if each station were organized and working during the entire year. As a matter of fact, only the 11 stations now in operation would draw upon these funds from the beginning. First these would have to be reorganized in accordance with the plan outlined, then new stations organized and put into operation as rapidly as possible. Some delay would inevitably occur before all arrangements could be made with the municipalities where stations may be located, and they be able to fulfill their part. Allowing that this delay would cause a reduction of 20 per cent in the entire year's expenses, the annual estimate is thus reduced to $80,000.

We recognize that this sum is a large advance over the present appropriation of $15,000, of which nearly $11,000 was expended during six months' work. Here it must be taken into consideration that two of the members of the present commission are officers of the United States and received no monetary recompense whatever from the insular government. Also that they were supplied with the greater portion of the laboratory equipment by their services without expense to the appropriation. This assistance will be lacking in the future.

Again attention is called to the fact that the substations at Barros, San Sebastian, and Moca have cost the commission only the expense of the medicines and transportation of the same. The physicians at these places so desired to take part in this labor, and, dissatisfied with the results obtained in the treatment of this "anemia" by iron, tonics, etc., so desired to extend the benefits of scientific treatment to the anemics of their localities, that they volunteered their services to take charge of these stations without recompense from the commission. Even to those physicians who were remunerated, the amounts paid were miserably inadequate for the services rendered. This is a sacrifice of time and labor which Porto Rico has no right nor need to demand, but should reasonably recompense such valuable services. "The laborer is worthy of his hire."

While the operations of the present commission have been carried out on a really large scale, yet in proportion to the conditions confronting us it has been comparatively small. By reference to the financial statement, it may be seen how economically it has been done.

In 1903, a systematic examination of the miners of Westphalia showed that 17,161 of 188,730 miners were infected by the parasite causing this disease.

In certain mines, during nine months' work, the infection was reduced 73 per cent. In addition to the large sums contributed by the miners and mine owners, the German Government spent 3,000,000 marks ($720,000). We have treated 18,865 cases in six months, at a cost of $10,908.77, and have reduced the infection 94 per cent among those treated.

The success attending our efforts convinces us that what this commission and its coworkers have accomplished on a comparatively small scale can be done on a sufficiently large scale to meet the urgent need of Porto Rico. It is simply a question of funds and proper administration by those who have knowledge and experience in this particular field. We do not believe that $80,000 will meet fully the condition that it is proposed to attack, but it is probably sufficient to

cover what can be done during the coming year. In following years new stations should be established in places that may be but remotely touched by the present estimated work, or in case some stations should have accomplished their end, they could be moved to another place yet heavily infected, leaving only a dispensary to care for those few who may not have applied for treatment, and those few who become reinfected.

During 1904 this commission demonstrated beyond a doubt the character and curability of this "anemia," and during 1905, proved the feasibility, from both curative and preventive points of view, of the measures advocated. With this conviction of certain success, did we recommend any less, we would fail in the most important phase of our duty.

Slower yet more deadly than yellow fever, uncinariasis caused more deaths in 1905 in Porto Rico than yellow fever did throughout the entire world, notwithstanding the unusual prevalence of the latter disease during the year, yet cost is not considered in the presence of yellow fever.

No doubt the sum herein advised may seem startling to some, because they have not been accustomed to regard this work as a regular governmental expenditure. Large amounts for asylums, police, jails, quarantine, and the vast machinery of the law are expenses to which everyone is familiar, and they are expected as a matter of course. During the fiscal year 1904–5 $457,320.54 was expended for police and jails, the administration of justice requiring $262,250.36; the insane asylum $34,420.73 to care for such unfortunates; for the leper asylum, $7,079.95 to care for and protect others from its inmates; for the boys' charity school, $32,317.47; the girls' charity school, $18,064.63.

We do not wish to belittle the necessity for such expenditures nor to criticize them, as we recognize that such are necessary if a government fulfill its primary duty—the preservation of the lives and health of its citizens. We do wish to emphasize by comparison with accepted expenditures that the amount that we advise is small in the face of such vast need and in relation to the great benefits to be received, not only in saving of life and suffering, but a financial economy of thousands of dollars to laborer, employer, and the island generally.

We most earnestly advise and urge that the campaign against uncinariasis in Porto Rico be pushed with utmost energy. It would be economy of life, time, and money to expend from the first the greatest amount possible to obtain from every resource. The greater the amount expended now means the sooner and cheaper the results will be accomplished. The greater number treated the less number to spread infection, and a resulting less number reinfected each year. In all discussions about this disease much attention has been paid to the prevention of it. We have shown that the wholesale treatment of the infected, thus removing numerous foci of infection, is the most thorough and practical method of prevention. Our experience coincides with that of the German workers in this same question. It is a simple arithmetical computation to show that small appropriations will simply prolong, almost indefinitely, the conditions now existing, and the money expended would be a constant drain on the insular treasury, amounting to much more in the end.

The stations once established, the per capita cost of treatment becomes proportionately less as the number of patients increases, because the actual cost of medicines (including transportation of same) is but a few cents, and, while this cost would be increased somewhat, other expenses would not be materially affected. Thus a large number of persons can be treated almost as cheaply as a much smaller number.

We estimate that about 800,000 of Porto Rico's 1,000,000 inhabitants are infected with the parasite causing this disease, and that the infection is increasing, i. e., those yet unaffected are becoming infected, and those already infected are becoming more heavily so.

By the expenditure of the amount advised we estimate that over 100,000 persons can be treated. Until large numbers are treated, thus destroying numerous sources of infection, the disease will continue to increase or hold its own. Sooner or later large sums must be spent, and until then the loss of life, time, and money which could have been saved will have been sacrificed for nothing.

The problem of attacking uncinariasis is now confronting almost every country of tropical and subtropical climes, not to speak of the many infected mines of more northern countries. Porto Rico has taken front rank in the solution of this problem by the vigorous campaign which has been inaugurated. Its work has become known and watched by the entire world. To allow it to end at this point or even to fail in fulfilling, to the limit of its resources, its plain, imperative duty in the matter would be to lose a great part of what has been accomplished at the cost of much labor and money.

FINANCIAL STATEMENT.

Salaries		$4,426.90
Medicines		2,086.24
Actual cost of medicines	$2,086.24	
Transportation of same	397.96	
	2,484.20	
Average cost per patient, 13.11+ cents.		
Subsistence, 9,994 rations of patients and employees at 14.31+ cents		1,430.51
Travel, members of the commission, directors of substations, etc		667.06
Transportation		646.00
Medicines	$397.96	
Hospital from Utuado to Aibonito, and materials	193.57	
Laboratory supplies	4.85	
Clinic supplies	3.66	
Miscellaneous	45.96	
	646.00	
Installation, repairs, house for employees, etc		520.23
Printing, stationery, and office supplies		307.14
Hire of carriage (including driver, etc.) for service between Aibonito and hospital		267.00
Laboratory		234.41
Installation, etc	$30.68	
Supplies and apparatus	203.73	
Transportation	4.85	
	239.26	
Instruments for clinic		141.52
Microscopes	91.00	
Slides, covers, and miscellaneous	50.52	
Transportation	3.66	
	145.18	

Postage and telegraphing	$44.84
Miscellaneous	36.92
	10,808.77
Appropriated by municipality of Aibonito, expended for labor of installation	100.00
Total cost of six months' work	10,908.77

Average cost per patient, 57.82+ cents.

Complications and intercurrent diseases.

CENTRAL STATION, AIBONITO.

Tropical diseases:

- Filariasis — 7
  - Clinically diagnosed.
- Elephantiasis — 2
- Chronic ulcer of the leg — 31
  - Loosely termed "anemic ulcer," "tropical ulcer," etc. Often due to severe secondary infection following mazamorra.
- Dysentery — 22
  - Confirmed as amebic dysentery by microscopic examination in several cases. The type was usually chronic and the clinical picture was the same. All were probably due to ameba coli.
- Bilharziosis recti — 5
  - Diagnosed by microscopic examination.
- Malaria — 29
  - Included here because tropical forms predominated. Almost always diagnosed by microscopic examination.
- Unknown — 1
  - This disease, to which reference was made in the last report of this commission, is termed "La Hermosura" ("The Beauty") by the country folk and is characterized by anasarca, fever, and tendency to fatal termination. There may be no albumin in the urine and even no anemia. It is regarded by some as a form of acute uncinariasis.

Affections which may be in some manner related to uncinariasis:

- Icterus — 4
- Stomatitis — 2
- Cataract — 11
  - One of these cases was a boy of only 12 years of age. The cataract was complete and not congenital.
- Night blindness — 2
  - Probably many more existed, but the question was put to but few patients. We have noticed that it is not an infrequent condition.

Affections which may be in some manner related to uncinariasis—Cont'd.

- Nystagmus — 4
- Retinal hemorrhage — 1
- Partial amaurosis — 7
  - Pathological condition not known.
- Vicarious menstruation — 1
- Gangrene of legs — 1
  - Due to failing circulation and extreme œdema.

General infectious diseases:

- Pulmonary tuberculosis — 32
  - Not a very freqnent disease in the country. A large proportion came from the town.
- Tuberculosis of the larynx — 2
- Tuberculosis of hip joint — 1
- Scrofula — 1
- Lupus — 2
- Cervical adenitis, tubercular — 3
- Tuberculosis, elbow joint — 1
- Gastric cancer — 1
- Epithelioma nose — 1
- Syphilis, acquired — 3
  - Not as infrequent as these figures would seem to indicate, as only well-defined cases were noted. It is not, however, by any means common in the country and is even very rare in certain localities. It is rather common in the towns.
- Syphilis, congenital — 1
- Gonorrhea — 6
- Trachoma — 1
  - Said to be very common in some schools in other parts of the island.
- Echinococcus of liver — 2
  - Diagnosed by microscopic examination.
- Typhoid fever — 3

Other diseases and conditions:

- Nephritis — 5
- Pyelitis — 1
- Renal calculus — 1
- Hypertrophy of prostate — 2
- Vesical calculus — 1
- Metrorrhagia, cause unknown — 1
- Hematuria, cause unknown — 1
  - Not due to filaria nor to bilharzia.

Complications and intercurrent diseases—Continued.

CENTRAL STATION, AIBONITO—continued.

Other diseases and conditions—Cont'd.

Hemorrhoids	3
Rhinitis, chronic	1
Cystitis, chronic	1
Diarrhea	144

Many of these cases were undoubtedly dysenteric in character, but as nearly all of these complicating diseases were brought out in the visits made by out-patients, we have been unable to do more in these instances than take the patient's statement as to the symptoms and character of the stools as observed by him in his home.

The source of these gastro-intestinal affections, in the vast majority of instances, is the use of impotable water from one of the sources of water supply in Aibonito.

The citizens of this town have promptly subscribed the money for an aqueduct which will contribute largely to make the town one of the healthiest on the island.

NOTE.—This aqueduct has been in operation since 1906, since which time epidemic diarrhea, dysentery, and typhoid fever have not existed.

Other diseases and conditions—Cont'd.

Cirrhosis of the liver	1
Tonsillitis	3
Hematemesis, cause unknown	1
Pneumonia	1
Asthma	4
Epilepsy	7
Hysteria major	7
Chronic rheumatism	4
Exophthalmic goitre	2
Otitis media	4
Corneal ulcer	1
Conjunctivitis	1
Bronchitis	2
Syringomyelia	1
Chorea	2
Insanity	1
Neuralgia	4
Spastic paraplegia	2
Psoriasis	2
Eczema	2
Vitiligo	2
Hernia	1
Harelip	3
Polydactilia	3
Deaf mute	2
Microcephalus	1
Dwarf	1

SUBSTATION, UTUADO.

Syphilis	2	Malaria	3
Nephritis	7	Idiot	1
Epilepsy	1	Asthma	1
Chronic rheumatism	13		

The director of this station has made a special study with regard to the number of women suffering from uncinariasis in whom the symptom amenorrhea was present. This number was 159.

SUBSTATION, LARES.

Influenza	4	Bronchitis	5
Malaria	7	Impetigo contagiosa	1
Puerperal fever	1	Chronic articular rheumatism	3

SUBSTATION, BARROS.

Chronic articular rheumatism	3	Scrofula	2
Valvular lesion of the heart	3	Malaria	2
Asthma	3	Hysteria major	2
Pulmonary tuberculosis	1	Stomatitis (aphthous)	1
Dysentery	1		

SUBSTATION, COMERIO.

Dysentery	2	Ulcer of leg	1
Malaria	23	Chronic rheumatism	2
Hemorrhoids	1	Scrofula	1
Asthma	2	Metrorrhagia	1

Complications and intercurrent diseases—Continued.

SUBSTATION, GUAYAMA.

Filariasis	2	Enterocolitis	1
Gangrene of penis and scrotum	1	Measles	2
Blepharitis	1	Epilepsy	1
Hysteria major	1	Renal calculus	1
Ulcer of leg	9	Impetigo	1
Pulmonary tuberculosis	4	Nephritis, chronic	1
Typhoid fever	1	Osteoperiosteitis	1
Syphilis	1	Gonorrhea	1

SUBSTATION, COAMO.

Malaria	20	Cirrhosis of the liver	5
Enterocolitis	18	Asthma	2
Laryngeal tuberculosis	1	Nephritis, subacute	1
Valvular (aortic) lesion heart	1		

SUBSTATION, SAN SEBASTIAN.

Malaria	32	Dysentery	8
Enteritis	13	Influenza	15

The following is quoted from an article written by Drs. Ashford and King, and read by Dr. Ashford at the Boston Medical Library meeting February 6, 1907, entitled "Observations on the Campaign against Uncinariasis in Porto Rico." It was published in the Boston Medical and Surgical Journal, Volume CLVI, No. 14, April 4, 1907, but we cite it here as it was part of the work of the Porto Rico Anemia Commission of 1905–6, and deals with some very important scientific points not brought out in previous reports for lack of time in which to prepare this material for publication:

* * * * * * *

Not only have we been able to experimentally corroborate skin infection, but we feel justified in saying that this is practically the only way the worm enters the body. We have never found a case which was clearly due to ingestion of the larvæ. The inhalation of infected dust does not merit consideration, as drying almost instantly kills them. On the other hand, we have seen that 96 per cent of 18,865 patients have acknowledged to having had an affection known the length and breadth of Porto Rico as a special and peculiar condition, not confounded with any other by those exposed to it, always acquired from contact of the bare but healthy skin with mud or muddy water, "mazamorra" or "ground itch." This mazamorra and the anemia of Porto Rico are always found together, and both are seen in exaggerated degree where the most perfect conditions for the development of the larva from the egg and its subsequent desiderata, constant moisture and shade, are found—the coffee plantation. On the other hand, both mazamorra and anemia are generally conspicuously absent among those who wear shoes.

The following experiment brings out in this connection a very interesting point and also demonstrates that we have in the guinea pig an animal capable of being infected by *Necator americanus*, a fact likely to be of value in future experimental work.

On the 1st of March, 1906, the feces of a newly acquired servant of the commission, heavily laden with eggs of uncinaria, was mixed in a Petri dish with such quantity of sterile sandy earth as to remove much of the offensive odor, a proportion of about 1 part of feces to 2 of earth. Water in sufficient quantity to give the consistency of mud was added, the dish covered and set away in the shade.

On the 4th of March larvæ were very plentiful to every field of a No. 3 Leitz objective. Some were moving lazily but the majority were apparently dead and lying fully straightened out. The immersion in excess of water of those which were before active brought all movement to a standstill. This effect was noted in about 15 to 30 minutes.

On the 5th of March the dish having been slightly tilted overnight and about two tablespoonfuls of water added, all larvæ in the water which had collected at the lowest level of the dish were motionless and straight, while those in the damp mud above this level were exceedingly active and encapsuled.

March 8 we found changes in the larvæ in the water which showed us that they were dead. Those in the damp earth were just as lively as before.

We took a 4-day-old guinea pig, reared under conditions where infection by uncinaria was practically impossible, clipped the hair from its back without subsequently shaving the area, made a mud poultice in cheese cloth about the size of a silver dollar from the upper part of the contents of the Petri dish in which the larvæ were found so active, and bound it gently on the animal's back, the pig being held for a half hour by the feet and head to avoid contact of its mouth with the mud. At the end of that time the spot was appropriately cleansed, rubbed well with absolute alcohol, and the animal returned to its cage.

The behavior of the pig after the first 5 or 10 minutes was remarkably suggestive, as he squealed and squirmed with unmistakable desire to scratch. March 9 the same procedure was repeated, the gentleman who had stocked the culture officiating as guard over the animal's feet. The same struggling took place in about the same time, and the man remarked, with an appreciative grin, that the pig was suffering with mazamorra.

On March 10 the same application was made. The pig seemed well. Absolutely no uncinarial dermatitis had developed in these three days. That night the pig died; the jibaro said that he had noticed him about six hours before, and that he had a very blue nose and seemed triste (sad).

Necropsy.—No edema; skin at site of infection, stomach, intestines, peritoneum normal. The kidneys and the liver were violently congested, but showed no larvæ. On opening the chest the cause of death was seen; the lungs were hemorrhagic. One lung was solid with blood and the other filled with dark-red, almost black, spots. One of these spots was excised, crushed between two slides, and examined with a No. 3 Leitz objective. Ten encapsuled larvæ were found, all very active, wriggling with an exceedingly violent movement. They seemed to overcome by their enormous strength all obstacles, breaking up lung tissue wherever it opposed them.

The larvæ seemed to be in the alveoli and are prone to seek little pools of blood.

The heart's blood was examined without result. Nothing else was found to be abnormal.

A very interesting deduction, among others more important and quite obvious, without any special attention being drawn to them in this paper, is that the so-called "natural cure," to us a rather trying process with so sure and rapid a remedy as thymol, is possible in a heavily infected country, provided that stout shoes are worn and further uncinarial dermatitis avoided. The fact that the ova of uncinaria never develop into larvæ in the intestine of the host, coupled with the fact that we have not seen infection to occur save by the skin not only explains why patients sick of anemia in the mountains gradually get well on taking up their abode in the cities of the island, where the mud of streets, even though subject to occasional contamination, is subjected to drying fatal to the life of the larvæ. It explains why the soldiers of the Porto Rican regiment, almost universally infected on presenting themselves for their first enlistment, but not to an extent to be noticeable, and thus to incapacitate them from acceptance in the physical examination for the service, are such perfect specimens of manhood after a few years, even in less time, from the day they were compelled to wear shoes and received the ample food and solicitous care bestowed upon them by their officers. Their alertness and physique are commented upon wherever they go, and they furnish excellent examples of what can be done by the redemption of the Porto Rican jibaro.

* * * * * * *

The food of uncinaria is shown when we come to examine the beautiful, almost diagrammatic, photograph of the worm in situ. This is a photograph of one of a number of uncinariæ which we removed from the cadaver, while the parasite was still alive and feeding, with a portion of the intestine to which they were attached. They were dropped immediately into alcohol. These specimens were imbedded and sectioned very skillfully by Dr. W. M. Gray, at the Army Medical Museum, and the accompanying photographs were also made by him, as were all others we take pleasure in being able to show you.

There are, at least, two valuable lessons to be learned from a careful inspection of these photographs of the worm in situ:

(1) The lesion is practically confined to the mucosa. (2) Although the animal had drawn into his mouth the submucosa, which has become completely denuded of epithelium, among the contents of the intestine of the parasite the conspicuous objects are epithelial cells—not red blood cells.

The picture here shown corresponds in every particular with a previous description and photograph published by Loos in "The Anatomy and Life History of Ankylostoma duodenale," Records of the Egyptian Government School of Medicine, volume 3, Cairo, 1905.

We feel obliged to conclude that the epithelium lining the intestinal canal of the host furnishes the normal food supply of *Necator americanus*, just as he previously describes it to be that of *ankylostoma duodenale.*

In conclusion we wish to note that in the immense majority of about 80,000 uncinariæ counted personally by us in the stools of our patients after the administration of the anthelmintic, as well as in those attached worms found in the intestines at necropsy, the worms did not appear to contain blood, but were generally grayish white. In fact, this peculiarity was made use of in the device adopted for their recovery from the stools, which were washed slowly down a trough painted black, the stool having first been filtered through gauze. In a report on ankylostomiasis by Löbker and Bruns, 1906, we find the following:

"The views of Loos were substantiated by Schaudinn, after a careful reexamination of a large number of Leichenstern's sections, when the intestinal contents of the ankylostoma were microscopically examined. Among 300 worms selected at random, he found 196 whose intestines contained cell fragments other than blood cells. In the remainder he found either nothing or else blood cells to a greater or lesser amount. Repeatedly long strips of intestinal membrane were traced, completely extending from the mouth through the alimentary canal into the intestine of the worm."

This is important information when we remember that Leichtenstern was the observer of all observers who was most identified with the teaching that ankylostoma duodenale was not only a bloodsucker, but was so prodigal of his food that he consumed blood entire to appropriate only the serum, evacuating blood cells practically unchanged. For this the noted authority dubbed the worm "the luxurious parasite."

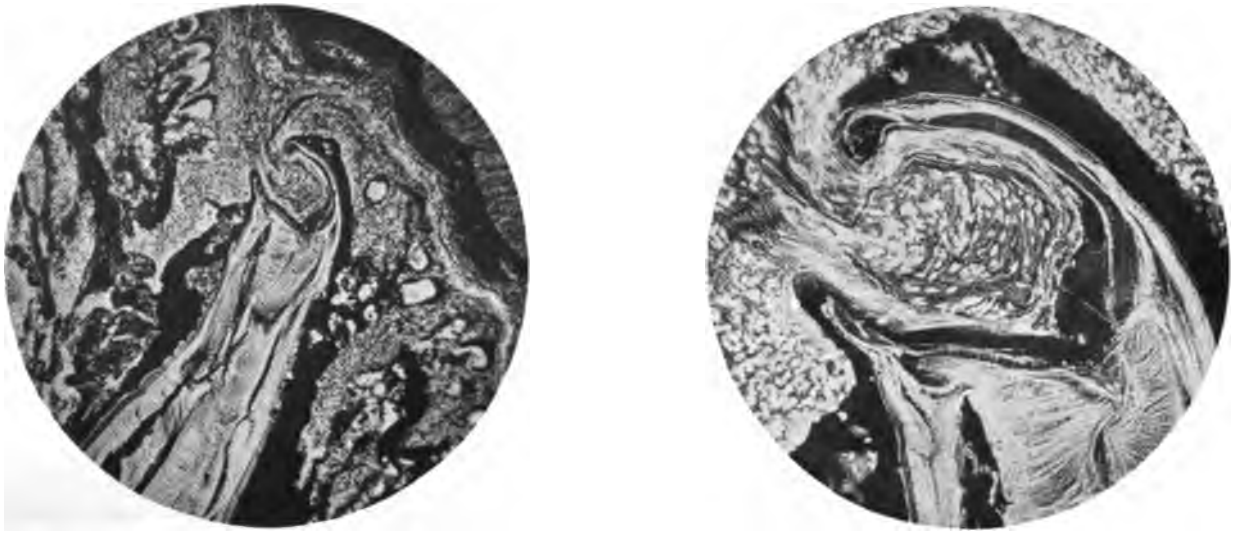
The urine in uncinariasis before and after treatment.—In the first report of the Porto Rico Anemia Commission it is stated that albumin is rarely found, although note is made that the kidneys may be very pale and slightly fatty, sometimes being the seat of parenchymatous or interstitial inflammation, sometimes of amyloid degeneration, but, generally speaking, without marked involvement of these organs.

We would like to considerably modify our former opinion. It was based on the examination of a series of cases, but was not made, as was the blood, a matter of special study, inasmuch as Heller's nitric acid test and the absence of clinical evidence gave us no clue to the real condition. It is significant that writers on uncinariasis make practically the same statement. As a matter of fact, the condition of the kidney in a well-marked case of uncinariasis is of the greatest importance, as will be shown. We noted the irritant effect of the anthelmintic drugs employed upon the digestive tract and found albuminuria after their administration, in accord with the experience of Löbker and Bruns, Calmette, Siccardi, and others with thymol and male fern.

Our plan for 1905, among other things, was to make a careful study of the therapy of uncinariasis and to that end a series of cases was studied in which the uncinariæ expelled were counted after each anthelmintic dose. This, together with manifold other duties, consumed about all the time available from the actual administration of so large a work as the treatment of some 25,000 persons.

From the first, however, our attention was attracted by one case to the immediate and imperative duty of more carefully investigating the urine. This was one in which nephritis occurred during treatment. Naturally, the first thought was, "Has the new anthelmintic, beta-naphthol, said to be at times a renal irritant, anything to do with this condition?" The second, "Is there a latent renal lesion present in the disease?" To determine these facts an additional series of cases were taken and our results follow with conclusions; but before considering these tables a few explanatory remarks should be made:

It was manifestly out of the question, for lack of time, to make complete quantitative urinalyses as we desired. The day was so split up by other work



A SAGITAL SECTION OF NECATOR AMERICANUS ATTACHED TO THE INTESTINAL MUCOSA.

Photographed by late Dr. W. M. Gray, U. S. Army Medical Museum, from a specimen contributed by the Porto Rico Anemia Commission, 1905.

and other investigation that it was decided to elicit certain facts only, and these with great care, so that a definite conclusion could be reached.

It was evident that an examination of the urinary sediment, as well as a determination of the presence or absence of albumin, should be made. In order to offer a series of cases carried far enough to furnish evidence that would be satisfactory, the continued presence of the patients in hospital was necessary, and this was precisely the most difficult part of the problem, as when they felt better they clamored to go back to work and stood not on the order of their going, but frequently went, spoiling for us many hours of toil. The original number of such cases is, therefore, reduced to 24. The practical impossibility of obtaining the 24 hours' urine and the numerous time consuming details to which we were obliged to attend personally, prevented us from making urea estimations. One of the occasions at which the urinary examination was needed was that at which purges had to be administered, and with the small force at our disposal collection of all the urine was impracticable. The invariable custom was to examine the urine on the day before and the morning of the day of treatment, before the anthelmintic was given; then the afternoon urine on the day of the specific drug and the morning after. Thus there were two examinations before and two after each administration of the anthelmintic and the samples were faithfully taken at the same time by our trustworthy nurses in the field hospital.

Albumin.—Three tests were always used at each analysis:

(1) The boiling of urine with a drop or two of acetic acid to six parts urine and one part saturated salt solution, the test tube nearly full and the upper half boiled to compare with the unboiled lower half in a good light against a dark background. We were aware that a very faint clouding could be thus obtained in many normal urines. (2) The ferrocyanide of potash test. (3) Heller's nitric acid test. When the first was faintly positive and the last negative, a slight trace was noted; when the latter was positive in a faint but characteristic ring, not disappearing on heating, a trace was noted. Only a very few times was albumin found in considerable amount. Ordinarily the amount was so small that its percentage could not have been determined by the Esbach albuminometer. The sediment was collected after standing some hours in conical test glasses and the urine was not centrifugalized. The casts were generally of the smaller varieties, hyaline and finely granular forms predominating. Blood casts were not seen in this series and epithelial casts were uncommon. Fatty casts were quite often noted. The presence of polymorphonuclear leucocytes was at times discovered before the administration of the anthelmintic, and there was a tendency for them to appear, sometimes in fair numbers, afterwards. Renal cells were not a very marked feature and were almost always scarce.

Urobilin was almost always present, fluorescence by the zinc-chloride test being elicited, but it was often remarkably slight.

Peptones in traces were found to be inconstant, but often demonstrable.

Indican in abundance, as Siccardi recently states, was a very constant and persistent phenomenon.

Bile pigment was relatively rarely found.

A most interesting fact was the invariable absence of the diazo-reaction, save immediately after the administration of beta-naphthol, in 1 or 2 gram doses, when it never failed. Its presence was demonstrable three to four hours after the dose, and its effect lasted five or six hours. The next day it was always absent. When it was present it was beautifully pronounced and was an unfailing evidence of whether or not the drug had been taken. The color of the urine was frequently some shade of olive after thymol, a color developing or deepening on standing in the open air. Apparently, beta-naphthol did not affect the color of the urine. The reaction was practically always acid, rarely alkaline or neutral, as Calmette found in his cases.

The specific gravity tended to be low, but almost always increased under medication. Sugar was not found to be present.

From the tabulation of the 24 cases in which successive urinalyses were made the following condensed statement embraces the essential facts: Eighteen were males, 6 were females; 7 under 15 years of age; 12 were between 15 and 30; 5 were over 30. One case expelled no uncinariæ, had no symptoms of the disease but expelled 418 oxyurides in two doses of beta-naphthol (all she harbored). Two of the remaining 23 were suffering from a very light form of uncinariasis; 3 from a light grade; 4, moderate; 10, intense; 4, very intense. Thymol was the only drug employed in 10 cases; thymol and male fern in one

case; beta-naphthol alone in 13. The total number of doses of thymol was 45 and of beta-naphthol 62. The dose of thymol was 2 grams in children, and from 3 grams to 4 grams in adults; that of beta-naphthol 1 gram in children, and from 1 gram to 2 grams in adults. These doses were always preceded the night before by sodium sulphate and followed in two hours by the same drug. The anthelmintics were always administered by dividing the dose above mentioned into two equal parts, one given at 8 and the other at 10 a. m. Male fern was given but twice in this series. These two doses were given successively to the same patient, 2½ and 4 grams, respectively, and resulted in the expulsion of only two uncinariæ. The alcoholic extract was used in each instance and it was presumably fresh, as it was employed immediately after it arrived by mail from one of the best known pharmaceutical firms in the United States. This was not the only occasion upon which we used male fern, and its failure to expel *Necator Americanus* was observed in several other trials where the preparations of other firms were used. In this particular case this observation was especially interesting, as one week after the fruitless administration of male fern only 3 grams of thymol were given, and by this one dose 3,686 uncinariæ were expelled from the same patient.

Of the 23 who expelled uncinariæ, in 1 case the worms were not counted. In the rest, 9 expelled less than 300, and of these 2 had no albumin in their urine before the administration of the anthelmintic; 5 had a slight trace, 1 a trace, 1 a considerable amount. Eight expelled between 300 and 1,000 uncinariæ, and of these 1 showed no albumin before treatment, 6 a slight trace, 1 a considerable amount. Three expelled between 1,000 and 2,000, and of these 2 showed a slight trace and 1 a trace of albumin before the drug. Those who expelled more than 2,000 uncinariæ (one 2,749; the other 4,395, the largest number expelled in our series of worm counts) gave only slight traces of albumin before treatment, demonstrable solely by boiling.

Of the total of 24 cases, 20, or 83.3 per cent, are seen to have had albumin in the urine before the administration of anthelmintics. One of these cases was not one of uncinariasis and had no albumin nor casts, but developed a very slight trace of albumin under treatment. In 18 of these 20 cases, or 75 per cent, casts were also demonstrated. Generally the casts were very few in number: in only 6 of the 18 were they at all abundant. The average hemoglobin in those persons showing albumin before the administration of the anthelmintic was 46.1 per cent; that of the 4 who had no albumin before the dose was 80.5 per cent. Sixteen of the 20 cases showing albumin before taking the specific drugs had but a slight trace, 1 a trace, 3 a fairly abundant amount. Albumin increased in amount under treatment in 15 cases and appeared for the first time after the anthelmintic in 4, a total of 19. Albumin did not increase under treatment in 5 cases, although it existed at the beginning. Finally, of the 220 urine records here recited, 118, or 53.63 per cent, showed but a slight trace of albumin; 34, or 15.45 per cent, a trace; 19, or 8.63 per cent, a moderate amount; 22, or 10 per cent, much albumin; and 27, or 12.27 per cent, showed no albumin. Hyaline casts were demonstrated in 133 of these examinations, in 100 of which they were few in number; granular casts in 103, in 71 of which there were few; epithelial casts in 21; fatty casts in 23. Of the 41 records of moderate or much albumin, about two-thirds occurred after the administration of anthelmintic drugs

Conclusions.—Our conclusions are not based alone upon this series of cases, but embrace a much larger number of observations, too scattered to place in tabular form. It is believed that the data contained in the series of 24 cases represent what is generally found before and after the administration of thymol and beta-naphthol.

1. Albuminuria with tube casts is a very common phenomenon in uncinariasis.
2. It may be present in light or severe cases, more constant in the latter.
3. Albumin is present generally in very slight traces, not discernable by the Heller nitric-acid test, but is usually accompanied by a few casts.
4. The casts are generally hyaline, finely granular, and fatty; rarely epithelial, unless the epithelial cells are very fatty, when they are classed as fatty casts. Blood casts are very rare.
5. Albumin may be present in light and heavy infections.
6. Albuminuria, with casts in uncinariasis, should be regarded as the evidence of a degenerative process in the kidney, not as an inflammation or, more specifically, a nephritis.
7. Both thymol and beta-naphthol can act as renal irritants, especially in the presence of this condition of the kidney.

CONTENTS OF SAME WORM, × 200 DIAMETERS.

Photographed by late Dr. Wm. Gray, U. S. Army Medical Museum.

1.

2.

SPECIMEN CONTRIBUTED BY AUTHORS, SHOWING MALPIGHIAN CORPUSCLE OF THE SPLEEN AND THE REDUCTION IN LYMPHOID ELEMENTS.

Photomicrograph of spleen in uncinariasis, × 200 and 300, by late Dr. Wm. Gray, Army Medical Museum.

8. While ordinarily these drugs cause an increase in albuminuria and often bring it about where before it was absent, their effect is temporary, causes no symptoms in the vast majority of cases, and is rarely of importance.

9. There is almost always an absence of inflammatory elements after the above-mentioned increase in albumin.

10. Very rarely they may set up a severe nephritis.

11. The cases herein cited show that both drugs seem to have an equal power to increase in albuminuria with tube casts, but our experience over a large number of cases demonstrates to us that, all things considered, beta-naphthol has a very much less favorable action on the kidney, and that it is not as safe as thymol for this reason, although its depressant effect is not so marked. Thymol has not, in our experience, caused fatal collapse.

12. Albuminuria does not always seem to depend upon the grade of anemia.

13. Albuminuria and the changes found in the kidney after death may be due to a specific toxin elaborated by uncinariæ, but where severe anemia exists such an explanation for the condition is hardly needed.

14. Uremia in Porto Rico is not uncommon, but is rarely seen by a physician, and is confused by the jibaros with "nervous attacks" of all kinds, particularly with the very common hysteria major. Epilepsy is not uncommon, and we are persuaded that sometimes this diagnosis would suffer a change on examination of the urine. We know of several instances where there was good ground for believing that the attacks were uremic in character.

15. Emphasis must be laid on the fact that the albuminuria of uncinariasis is extremely irregular, coming and going without the slightest apparent reason.

16. Renal accidents from the use of the anthelmintics under consideration are not generally serious and are still more rarely fatal. The great severity of the present epidemic and the high mortality should make us disregard the remote danger to the patient from the use of thymol.

17. The use of beta-naphthol should be restricted to very few doses, and its administration should be limited to patients in extreme grades of the disease, on account of its less depressing effect on the vital centers—until enough uncinariæ are expelled to create a favorable reaction and enable us to use thymol. However employed, a dose of 2 grams should not be exceeded and no more than three successive doses given—one each week.

In another article, entitled "Uncinariasis: Its development, course and treatment," by Drs. Ashford and King, read in the section on practice of medicine of the American Medical Association at the fifty-eighth annual session, held at Atlantic City, June, 1907, and published in the Journal of the American Medical Association August 10, 1907, Volume XLIX, pages 471–476, we deal with the gross morbid anatomy and microscopic changes revealed in the tissues of persons dying of uncinariasis in the stations of the commission in the fiscal year 1905–6. These studies were pursued in Washington during the work of the commission of 1906–7 in Porto Rico, but pertain to the work of the year 1905–6. We quote from that article as follows:

MORBID ANATOMY.

Despite the great amount of literature on uncinariasis in recent years, no subject is so barren of data as its pathologic anatomy, and yet this is decidedly one of its most interesting and instructive features. Not only are uncomplicated cases, suitable for the drawing of conclusions, difficult to acquire, but the consent of the relatives to autopsies is by no means easy to secure. Above all, deaths occur far out in the country, and usually before an autopsy can be performed post-mortem changes are well advanced. The latter obstacle was our most troublesome one, as the death rate in our field hospital was very small; indeed, it was but one-third of 1 per cent for the entire number of 18,865 treated between May and December, 1905, at all stations combined.

In spite of these difficulties 11 out of 12 autopsies were made in such manner as to furnish accurate information, in so far as the gross anatomy is concerned; 9 supplied us with tissue in a very good state of preservation for microscopic study. The minute anatomy of the other 2 is not included on account of the length of time after death at which the autopsy was made. Of the 9 specified

above, 1 subject was 5 years of age and had never received any anthelmintics, 1 was 14, and the remainder between 25 and 50. Six showed extreme anemia, 1 other was an intense case, and 2 more were moderately severe. Only 2 were complicated by other conditions; in 1 a healed lesion of pulmonary tuberculosis was found; the other presented the intestinal lesions of amebic dysentery. Nothing was shown in the latter to invalidate our conclusions.

GENERAL OBSERVATIONS.

As a rule, the body shows no emaciation, and the amount of adipose tissue is apparently normal. There is not only much edema, but all soft parts, including skin, muscle, and internal organs, have suffered great change in color, due to the intense anemia. The skin and subcutaneous tissue are very pale and sodden with fluid. The muscles are brownish gray, friable, and often atrophied. On microscopic section the individual muscle cells are frequently separated, and the protoplasm seemingly starved and reduced in amount, an observation which, indeed, applies to nearly all organs.

On opening the abdomen, an excess of pale yellow or straw colored peritoneal fluid is observed, the amount reaching enormous quantities in certain cases where ascites is a prominent feature. In one of our cases this serum was reddish yellow, but no adhesions or other signs of inflammation were found. Serous effusion is also generally demonstrable in the pleuræ, pericardium, and sometimes in the cerebral ventricles.

THE HEART AND LUNGS.

There was often hypertrophy, although not rarely a heart of normal size was encountered. It was not unusual to see an excess of pericardial fat. Not uncommonly, however, dilatation had occurred, and the organ was remarkably flabby and easily torn. Microscopically in two of three autopsies brown atrophy was well marked, and a slight degree of myocarditis was discovered. Fatty degeneration of the muscle fiber was clearly seen in two cases after fixation of the tissue by Fleming's solution. The separation of individual cells was particularly noticeable and this was irrespective of the fixing reagent employed.

The lungs were frequently the seat of œdema and passive congestion.

THE LIVER.

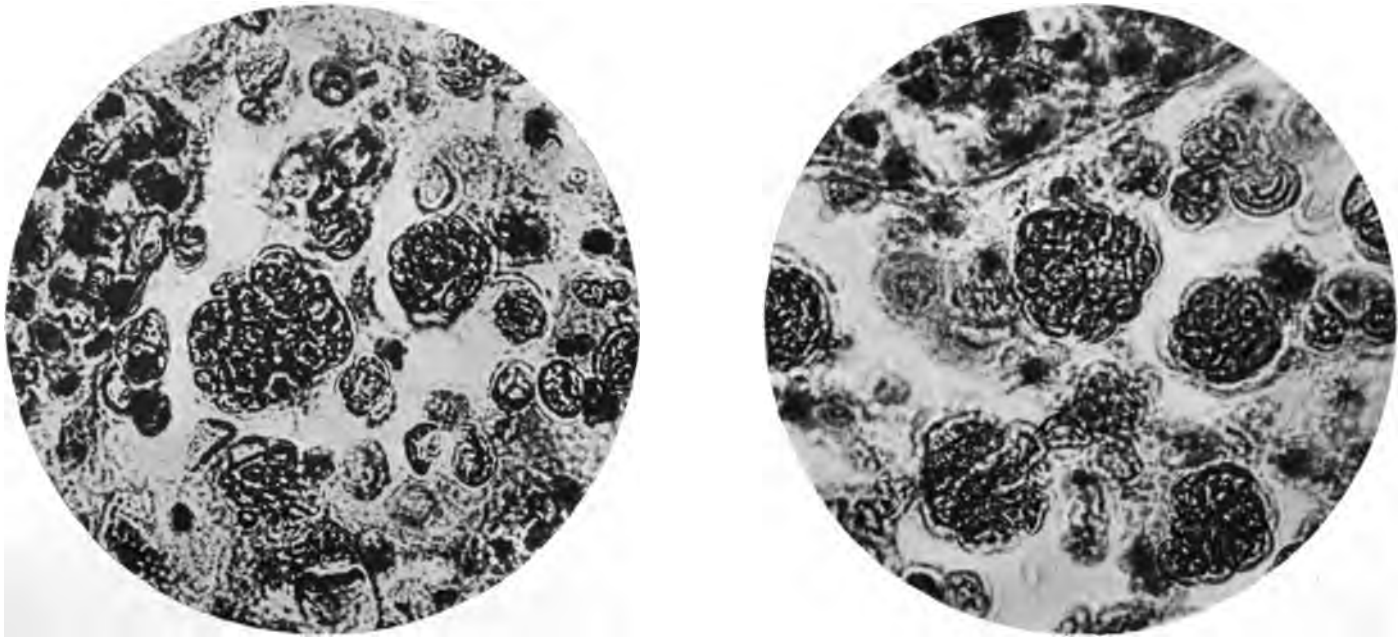
This organ was practically never normal. Great increase in size was only once discovered, although never was there diminution. Its most frequent color was a light brownish yellow. In some cases it was very light yellow, soft and greasy to the touch and extremely friable. Microscopic sections demonstrated that it was often extensively affected in uncinariasis. Extreme fatty degeneration was the prominent feature of four cases, and in two scarcely a normal liver cell could be found, the condition of the liver here simulating marked types of fatty changes in other diseases characterized by such changes. In none of our autopsies was fatty degeneration absent. In its least exaggerated form it chiefly affected the outer third of the lobule.

In three cases there was increase of connective tissue in the portal spaces, but in two of them the change was only slight, and in at least one, where there was great increase, the condition was probably due to chronic alcoholism. Connective tissue increase is evidently not a feature of uncinariasis. Daniel's observation that the liver contains considerable yellow pigment could not be confirmed save in one case, although small amounts were found in others. The pigment was not stainable by potassium ferrocyanid. Extreme dilatation of capillaries was found in two cases.

THE KIDNEYS.

These organs were also profoundly involved. They were very pale and were apt to be slightly enlarged. As a rule, the capsule stripped easily. Microscopic sections showed us a practically constant picture of chronic parenchymatous, or chronic diffuse nonindurative nephritis. In persons of middle age who had suffered for some years from uncinariasis, there was increase in connective tissues, but this was marked in only one case. Usually there was little or no connective tissue increase and polymorphonuclear leucocytes were conspicuous by their absence.

SAME SPECIMEN HIGHLY MAGNIFIED, SHOWING HYALINE DEGENERATION OF THE COATS OF THE CENTRAL ARTERY AND REDUCTION IN LYMPHOID ELEMENTS.



PHAGOCYTOSIS OF RED BLOOD CORPUSCLES IN BLOOD CHANNELS OF A HEMOLYMPH GLAND. CASE DIED WITH 10 PER CENT HB. PATIENT OF COMMISSION, 1905.

Photographed by Dr. Gray.

Changes were always found in tubules and glomeruli, but the convoluted tubules suffered most severely, and fatty degeneration and desquamation in them was marked. The collecting tubules were much less affected. There was extensive exudation into Bowman's capsule, with desquamation of its endothelial lining and much dilatation of the intracapsular space. Hemorrhages into Bowman's capsule, intertubular hemorrhagic areas, and blood and epithelial casts, were found in four of the nine bodies sectioned, and the picture was that of an acute condition superimposed on the usual chronic one described. All four of these had received betanaphthol. In one case, yellow pigment was found, but only in small quantity. In two instances embolic abscesses existed.

STOMACH.

It was not usual to encounter uncinariæ in the stomach, although 83 were found in its lumen in an autopsy previously reported by us.[1] We discovered several adherent to the wall of this organ in this year's series. A gastric catarrh was common and marked dilatation was noted in two subjects.

INTESTINE.

The jejunum contained most of the uncinariæ found at autopsy. Some were unattached, others were adherent to the mucous membrane. In the first part of the duodenum were to be found most of the rest, a few being discovered in the ileum. None were encountered in the colon.

In more than one instance the parasites were alive 12 to 15 hours after the death of the patient, whether attached or free. They were rarely red, generally white or grayish. On one occasion they were removed with some little force by fine forceps and placed in physiologic salt solution, where they lived and remained active for about 60 hours longer and then were killed for experimental purposes.

The lesion of the intestine is confined, as far as we know, to the mucosa. It was found to be a tiny superficial erosion, not a deep ulcer, as many suppose, about 0.5 mm. (1–50 inch) in diameter and not usually characterized by any redness, save at one autopsy (1905). These erosions were very difficult to find without a hand lens, unless a parasite had just been removed from its feeding ground, and the locality marked. The duodenum, and especially the jejunum. are the seats of a chronic intestinal catarrh, and many times after we supposed that all parasites had been removed in the course of the examination of the intestine at autopsy many more were found buried in the thick mucus which more or less completely covered them.

The rest of the intestine, and even the colon, is apt to share in less degree in the general chronic inflammation. Degeneration and atrophy of the mucosa of the intestine, as well as of the stomach, were commonly observed. We have purposely left to the last a consideration of the really striking changes in the spleen, hemolymph glands and bone marrow, as these are marked and, until now, neglected in all treatises which we have read on uncinariasis.

The greatest number of uncinariæ are to be found in the upper and middle thirds of the jejunum. We have found them also in the duodenum and jejunum. We have not observed many worms to be attached at the time of autopsy. At our autopsy cited in American Medicine, September 12, 1,487 uncinariæ were found—83 in the stomach (possibly dislodged in the manipulation), 169 in the duodenum, and the rest in the jejunum. Perhaps this discrepancy may be explained by the fact that the hooks of the old-world species are the cause of their adherence to the intestinal wall.

We have not seen fatal cases with few parasites unless death was due to complications. We have not observed that the lesions described by Roth and others are so prominent in infection by *Necator americanus*. Roth describes them as ashen-gray nodules, 0.8 mm. in diameter, with a red center 0.3 mm. in diameter, and surrounded by an indurated area. In our autopsies the feeding ground of *Necator americanus* can easily be passed over without being noted. As to blood in the intestines, we have never found it. Not even have we found blood-stained mucus. That it occurs is seen from the numerous reports of others.

(The next year blood-stained mucus and tiny red points were found at one autopsy.)

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[1] Amer. Med., Sept. 5 and 12, 1903.

THE SPLEEN.

Most authors state that the spleen is not enlarged, but lead us to believe that it is normal. As a matter of fact, the spleen frequently is reduced in size, soft, and possesses a wrinkled capsule.

Dr. Rafael Cesteros, of Guayama, Porto Rico, the director of the commission's substation in that city, reporting on one autopsy, writes of this organ as follows:

"The atrophy of the spleen attracted my attention. It was as small a spleen as I have ever seen in my professional career, and at no autopsy, whether made for scientific or for medico-legal purposes, have I encountered this organ of such reduced dimensions. Its color was that of wine lees and its size was not greater than that of the kidney."

Microscopic sections revealed in every one of the eight autopsies in which a portion of the spleen was preserved, a great paucity of lymphoid elements, even decided decrease in the protoplasm of the cells. The Malpighian corpuscles were greatly reduced in size, the cells were scanty and widely separated, and the central artery presented, almost uniformly, considerable hyaline degeneration. Not only were the tufts smaller than normal, but they seemed fewer in number.

The apparent increase in connective tissue we explain by the decided reduction in lymphoid elements and blood, and it seemed relative rather than absolute, although in some instances thickening of the capsule was observed. Pigmentation was only once very prominent, and the pigment was of the same character as that seen in the liver. There was unusually little blood in the organ.

HEMOLYMPH GLANDS.

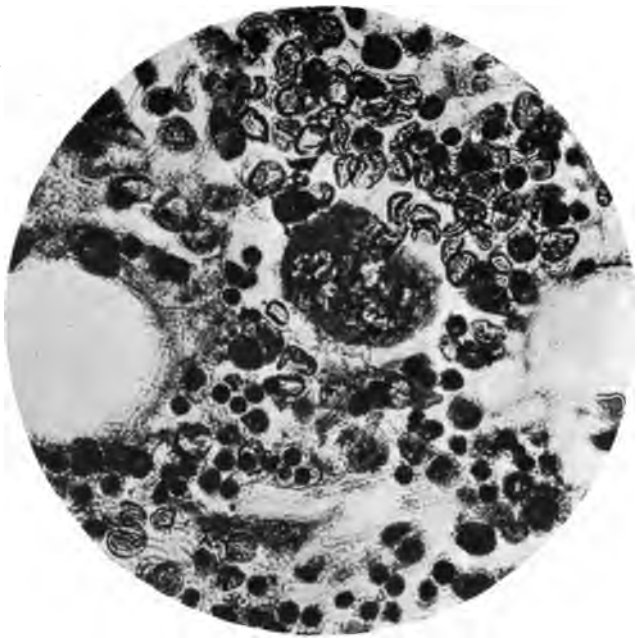
The following notes were made by us at one of our autopsies:

"Great abundance of glands in the region of the abdominal aorta was noted, especially at its bifurcation. They were enlarged, and of a dull reddish hue, like pale muscle tissue. Some of these glands were as large as hazel nuts, yet there was not a trace of inflammation in the surrounding parts, and the peritoneum over them was normal and glistening."

They were only sought for in one other autopsy, and then were found with the same characteristics, but in smaller number. Microscopic section showed that they were hemolymph glands, usually of the type described as splenolymph glands. Mitoses and phagocytoses of red cells were noted.

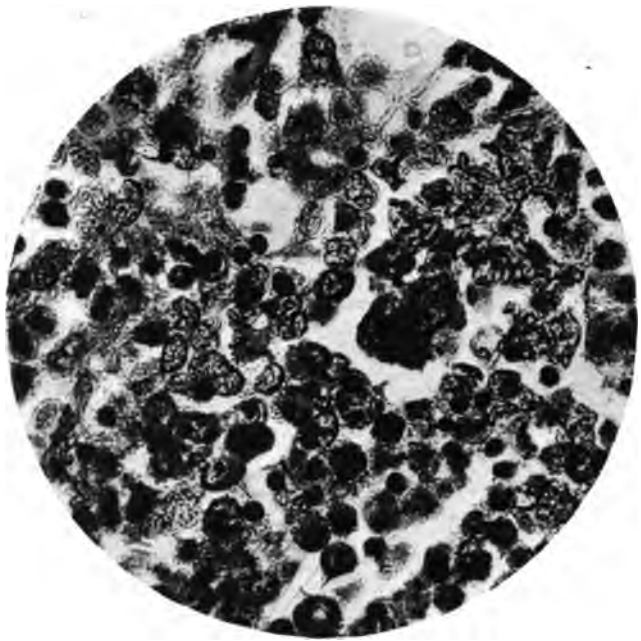
BONE MARROW.

The marrow of the midpoint of the shaft of the femur was examined in two autopsies. It was grayish red and very soft. Microscopic section disclosed, in addition to the changes described in the marrow of subjects dying of pernicious anemia, groups of eosinophilous cells, generally myelocytic. These cells were abundant, as were myeloplaxes. No attempt has been made to describe in detail the changes to be found in the organs referred to in this brief summary.



BONE MARROW, MID SHAFT OF FEMUR, SHOWING MYCLOPLAX AND NORMOBLASTS. CASE DIED WITH 10 PER CENT HB. PATIENT OF COMMISSION, 1905.

Photographed by Dr. Gray.



BONE MARROW, MID SHAFT OF FEMUR, SHOWING GROUPS OF EOSINOPHILES. CASE DIED WITH 10 PER CENT HB. PATIENT OF COMMISSION, 1905.

Photographed by Dr. Gray

THE THIRD REPORT OF THE PORTO RICO ANEMIA COMMISSION.

COMMENT UPON THE REPORT OF THE COMMISSION FOR 1906–7.

The authorized edition of this work was the Spanish edition. The chairman of the commission intrusted the labor of translating it to persons whose knowledge of the English language was limited and the result is that we have to request all who have read the English edition to discard it and accept the one which herein follows, as many incorrect ideas of the campaign during this year might be formed from the poor translation to which it was unavoidably subjected. Even as it is here, it is far from satisfactory, but at this late date it is impossible to make any radical changes in this large work, which has already consumed over six months in preparation.

The chapter entitled "Notes contributing to the study of uncinariasis" has been greatly reduced by omitting material contained in two articles written by Drs. Ashford and King, entitled "Uncinariasis, its development, course, and treatment" and "Observations on the campaign against uncinariasis in Porto Rico." These articles were cited separately, as they were published first in the medical journals.

The report has been also further reduced by the omission of the large amount of statistical data, which is elsewhere summarized, and by the reproduction of only about one-tenth of the substance of the reports of the various directors of anemia stations.

LETTER OF TRANSMITTAL.

SAN JUAN, P. R., *September 30, 1907.*

SIR: We have the honor to transmit herewith a report of the work performed by the Porto Rico Anemia Commission during the fiscal year 1906–7.

In this report we set forth the plans adopted by the commission to check the advance of uncinariasis in Porto Rico, the statistics concerning the cases under treatment at the several stations in the island, the scientific and more important data acquired by the study and treatment of the disease, an itemized statement of the expenses of the commission up to June 30, 1907, and suggestions for educational and sanitary measures that should be taken to extirpate this plague.

The work of the commission and that of the stations has continued uninterruptedly during the preparation of this report, and the cam-

paign against the disease we are trying to check is also going on without intermission during the current fiscal year.

Very respectfully,

P. GUTIÉRREZ IGARAVÍDEZ, M. D.
I. GONZÁLEZ MARTÍNEZ, M. D.
FRANCISCO SEIN SEIN, M. D.

Hon. RÉGIS H. POST,
Governor of Porto Rico.

AN ACT TO CREATE A PERMANENT COMMISSION FOR THE SUPPRESSION OF UNCINARIASIS IN PORTO RICO.

Be it enacted by the Legislative Assembly of Porto Rico:

SECTION 1. For the suppression of the disease known as tropical anemia or uncinariasis in Porto Rico, there is hereby created a commission which shall be known as "The Porto Rico Anemia Commission." Said commission shall be composed of a director and two assistant directors, who shall be qualified physicians, and shall be appointed by the governor, with the approval of the executive council, for a term of four years, and until otherwise provided by law, shall receive, the chairman two thousand five hundred dollars per annum and the associates two thousand dollars each per annum.

SEC. 2. It shall be the duty of the said commission to use all means in its power to prevent, combat, and suppress the disease known as tropical anemia or uncinariasis in Porto Rico, and for this purpose it is directed and authorized to establish and maintain a central station and such substations and dispensaries as, in its opinion, are necessary and are within the resources at the disposal of the commission for the treatment of persons suffering from uncinariasis, and to take such other action as, in its opinion, will contribute to the suppression of this disease.

SEC. 3. The work of said commission shall be under the direct supervision of the governor, whose approval of all regulations of the commission, of the appointment of all physicians, employees, and other assistants, and of the expenditure of all moneys placed at the disposition of the commission, shall be required. No money shall be expended for the construction, repair, or rent of buildings to be occupied as stations, substations, or dispensaries, but it shall be the duty of the commission to seek the cooperation of the municipalities in its work and to secure from them the quarters needed by it, and such other assistance as the municipalities are willing and able to give; the commission may seek, in order to carry out its work, the cooperation and assistance of the officials of the bureau of health of the insular government.

SEC. 4. All property that has been acquired heretofore by the commission working for the suppression of uncinariasis in Porto Rico and belonging to the people of Porto Rico, and all records of said commission shall be turned over to the commission created by this act.

SEC. 5. To carry out the purposes of this act there is hereby appropriated, out of any money in the treasury not otherwise appropriated, for the balance of the fiscal year ending June thirtieth, nineteen hundred and six, and for the fiscal year ending June thirtieth, nineteen hundred and seven, the sum of fifty thousand dollars.

SEC. 6. This act shall take effect from and after its approval. Approved, March 8, 1906.

PORTO RICO ANEMIA COMMISSION.

Honorary members.—Dr. B. K. Ashford, captain, assistant surgeon United States Army; Dr. W. W. King, passed assistant surgeon, United States Public Health and Marine-Hospital Service.

Chairman.—Dr. P. Gutierrez Igaravidez.

Associated members.—Dr. I. Gonzalez Martinez, Dr. F. Sein y Sein.

Assistant physicians.—Central station, Rio Piedras, Dr. J. Marcano; district station at Mayagüez, Dr. M. Dueño; district station at Lares, Dr. J. Benet Valdes.

Directors.—Station at Bayamon, Dr. A. Stahl; station at Vega Baja, Dr. J. H. Amadeo; station at Guayama, Dr. R. Cesteros; station at San German, Dr. P. Malaret; station at Utuado, Dr. M. Roses; station at Ponce, Dr. A. Ferran; station at Coamo, Dr. L. Igaravidez; station at Comerio, Dr. M. De La Rosa; station at Manati, Dr. F. B. Cordero; station at Aibonito, Dr. E. Canino; station at Morovis, Dr. P. Rivera; station at San Sebastian, Dr. J. A. Franco; station at Juncos, Dr. P. Palou; station at Corozal, Dr. A. Bou De La Torre; station at Yauco, Dr. R. Gatell; station at Barros, Dr. G. Santo Domingo; station at Barranquitas, Dr. F. Vizcarrondo; station at Isabela, Dr. L. Gonzalez Garmendia; station at Quebradillas, Dr. V. Roure; station at Las Marias, Dr. A. Oms; station at Humacao, Dr. I. Vidal; station at Caguas, Dr. V. Gutierrez Ortiz; station at Añasco, Dr. E. Casaldue; station at Arecibo, Dr. F. Susoni; station at Arroyo, Dr. E. Garcia Lascot; station at Vieques, Dr. G. Carrera; station at Cabo Rojo, Dr. A. Gaztambide; station at Cayey, Dr. F. Izquierdo; station at Aguada, Dr. J. Garriga; station at Aguadilla, Dr. B. Jimenez Serra; station at Adjuntas, Dr. C. Caballero; station at Fajardo, Dr. J. A. Diaz.

PLAN ADOPTED BY THE PERMANENT COMMISSION FOR THE EXTERMINATION OF UNCINARIASIS IN PORTO RICO.

The commission which had been engaged in the study of anemia in Porto Rico in 1904 and which had continued its labors throughout the following year was dissolved March 30, 1906, upon the return to their respective services of two of its members—Dr. B. K. Ashford, of the Army, and Dr. W. W. King, of the Public Health and Marine-Hospital Service. The results of the investigations of this commission are to be found in its reports for 1904 and 1905.

The importance of these studies, the clear demonstration that the great number of those suffering from uncinariasis in the island constituted a serious menace to the social and economic future of this country, was taken into account by our legislature, which passed a law creating a permanent commission to carry its work still further and into fields impossible heretofore to cover. This law was approved March 8, 1906, by the governor, Hon. Beekman Winthrop, but, although it was so framed as to permit the work to be taken up immediately upon its approval, it was deemed prudent to delay the operations of the new commission until the beginning of the fiscal year, on the 1st of July.

It was, therefore, not until June 25, 1906, that the governor designated the new commissioners and submitted their names to the executive council for approval. These nominations were:

President of the commission, Dr. P. Gutierrez Ygaravidez, formerly a member of the commission of 1904 and 1905. Members, Dr. I. Gonzalez Martinez, of Mayagüez, and Dr. F. Sein y Sein, of Lares, both of whom had participated in the previous work.

At their first meeting, in San Juan, July 2, and before proceeding to any other business, the commissioners requested of the governor the appointment of Drs. B. K. Ashford and W. W. King as honorary members of the permanent commission in recognition of their efforts in favor of the campaign which they themselves had initiated in this island and which the present organization was called upon to continue. This request was granted by the governor, and their credentials were accordingly forwarded them. The commission now proceeded to consider the mission confided them by law, the funds designated for this purpose, and the project for combatting uncinariasis in Porto Rico set forth by the former commission in their report for 1905. It was understood that two principles were clearly defined by the last commission for the solution of the problem, and their soundness was accepted by the present one. One was the cure of the disease in stations for treatment; the other was its prevention by the education of the patient at these stations.

The necessity for applying these principles was urgent and they were known to be practical of application, as seen from the experience of others besides ourselves in Europe and America who are confronting situations analogous to our own.

Every other measure in form of law which might be contemplated for the solution of the problem would have, perforce, to be tentative and at best but an aid to the two ends which this as well as the former commission desired to reach. We refer to propositions to authorize a propaganda against the disease from points where no stations of the commission existed, laws which would seek to secure a proper disposition of human feces, and regulations compelling the use of shoes to prevent the cutaneous infections occurring among our rural population.

The commission therefore decided to cure the highest number of infected possible, believing that this should be its first step in the direction of an ideal prophylaxis in a country where 90 per cent of its rural population harbored the parasite.

But the project of the former commission called for a greater amount of money than that appropriated for our future work. That commission recommended that $100,000 be employed as follows:

1. For the organization of a corps of physicians which, under a central direction, would carry on a campaign from stations, hospitals, and dispensaries, supplied with all of the instruments needful for clinical investigation.

2. For a salary which would be commensurate with the laborious duties which such a work would entail, at the same time relieving the physicians of all other obligations of a medical character.

3. For the creation of a corps of inspectors who would go through the country districts and encourage sick to present themselves for treatment at the same time that they would stimulate the people to observe the measures counseled for the prevention of the disease.

In a word, this plan had in mind the complete extermination of the disease. But not having more than the half of that sum of money at its disposal, the commission was forced to modify the original plan, which embraced the entire island with 7 great departmental stations and 30 smaller units called substations and dispensaries.

The question was raised concerning the propriety of concentrating the campaign in one or two districts, placing the stations in such a manner that, after a vigorous effort to cure and teach the special

prevention of the disease, such a district or districts would be swept clean of their uncinariasis; but the great agricultural activity of the island did not permit us to count upon the permanent residence of its laboring population in any given district long enough for us to obtain a cure and teach even the first notions of prevention. The constantly increasing vibration of the country people between the coast and the highlands made such a proposition impossible. Moreover, requests for aid from towns all over the island were urgent, inasmuch as the number of sick was so enormous, and the commission could not very well deny assistance to all municipalities wherever they might be, when it was pursuing a plan of extermination of the disease in one particular district.

Here we were not dealing with an epidemic in any one district, as in Germany, Belgium, France, and Spain, where uncinariasis was limited to mines, tunnels, and brickyards; we were face to face with a much graver problem—the total infestation of an island with an area of 3,606 square miles, with a mass of 800,000 country dwellers disseminated throughout the country districts, and with a soil offering the very best conditions for the development of the larvæ, prepared to infect man and produce in him the disease.

In view of all these facts, the commission did not deem it prudent nor reasonable to direct its campaign toward a single district nor to limit to one region the benefits which a humane law had directed should be distributed throughout all parts of the island. We felt that the problem demanded a general crusade, and we resolved to begin it and carry it as far as our resources would permit us. On the principle that the greater the number of units for treatment and propaganda, the greater the ultimate success of the work, we decided to create at least the same number of stations as the former commission had recommended to be established. In order to do this it was necessary to reduce the salary of the personnel at each station, deprive certain stations, designated by that commission, of the hospitals intended for them, and undertake to sustain a small number of patients at the three principal stations only for the purpose of studying the pathology and treatment of the disease. In order to carry into effect this plan, we decided that the commission should meet at stated times to discuss matters of importance for its successful accomplishment, but that each commissioner should reside in his own town from which he might direct the installation and progress of the work, making the necessary inspections in all towns in a territory whose limits were to be fixed by the commission as a whole.

Therefore, taking as a basis the number of inhabitants, the island was divided into three great zones, each one of which was placed in charge of a commissioner. Two of the three districts were directed from Lares and Mayagüez, whose stations were known as "district stations." The third was designated the "central station" and was in charge of the chairman of the commission. All of these district stations had practically the same number of stations under their supervision, but all depended for statistical data, general information, approval of accounts, etc., upon the central station. The need for a central station near San Juan, from which all stations in the island could be more easily supplied, was evident in a work planned on so large a scale, and the town council of Rio Piedras, about 7 miles from San Juan on the main highway to the south of the island,

with great generosity, placed at the disposition of the commission the best building in that town for the offices of the central station. The council paid for this building $600 a year, a donation to the work. This same generous attitude was taken by the municipal governments of Lares and Mayagüez, and in both of these towns houses were provided for the installation of the district offices and reception of patients at a cost to these municipalities of $370 and $250, respectively.

In all of these three stations, aside from the dispensary opened at each, a limited number of patients were hospitalized in conformity with the plan already traced.

In Rio Piedras, where the lack of a hospital prevented the town council from offering a building fit for this purpose, certain rooms were prepared in the building ceded for the central office for the reception of a few urgent cases out of the vast number which desired and needed hospital treatment. The municipal council nevertheless promised to cede part of a hospital, which at that time they were planning to build, as soon as it should be available for occupancy.

On the other hand, all municipalities in which stations were founded contributed to their support by fitting up and paying the rent of the house which they designated for a dispensary.

As the condition of the tents and other property used for a field hospital by the former commission did not permit us to use them for the same purpose this year, it was decided to leave them in store in Aibonito, where they had been left after the last year's work.

With the object of permitting other physicians working under the direction of the commission to carry on the same investigations which the commissioners were planning to make in their respective district stations, it was decided to allow sick to be treated and cared for in hospital by physicians in a limited number of stations, where the locality and number of anemics, from data furnished by the former commission, led us to believe that there were many who were seriously ill and where the towns were able to cede at least 10 beds in their municipal hospital. To such physicians a higher salary and a larger personnel were granted. In this category we placed the towns of Coamo, Guayama, Ponce, San German, Utuado, and Vega Baja. For all other municipalities, only the dispensary, with its out-patient work and examination of feces, was installed.

It was decided, however, that the directors of all stations should devote four consecutive hours a day to the examination, inscription, and treatment of applicants at the stations, and that the microscope should be employed to assure the diagnosis of the disease in each case.

As by no means every physician in charge of a station possessed a microscope and the accessories for the examination of feces, and as still fewer municipalities in which these stations were to be opened had these necessaries to furnish their physicians, it was resolved by the commission to furnish microscopes and accessories to some dispensaries until either their directors or the municipalities should be able to provide themselves with their own.

With this end in view, and realizing that every town ought to have a microscope, a necessity in these days for an adequate health service in towns, the commission invited the town councils to secure these instruments and thus cooperate with the work it was trying to do. At present the majority of towns where a station of the commission

exists have laboratory equipment which is the property of the director of the station or of the municipality; some still use that furnished by the commission, awaiting their own which they have ordered.

In this way, therefore, we have been able to systematize in all stations the microscopic examination of the feces in the case of every applicant for treatment for anemia, not only in cases where uncinariasis was merely to be suspected but in those in which a simple glance was sufficient to fix the diagnosis. Not only this, but this examination of feces was repeated at each visit of the patient and was what served to determine the fact of "cure" when at last the blood was restored to its normal.

The inscription of out-patients followed the same form as that adopted by the former commission, with slight modifications which experience had shown to be of value.

A card, which we denominated a clinical card, registered briefly the history of each patient and the course and treatment of his affection, specifying the result of the successive weekly microscopic examinations of feces, and the character and dose of the anthelmintic employed. This card had a serial number and remained at the station so that at each visit of the patient it could easily serve for reference.

The following is a copy of the card:

(Face of card.)

PORTO RICO ANEMIA COMMISSION.

Station of.....
Rural district.....
Farm.....

CLINICAL CARD.

No..... Name.....

Date.....Color.....Age.....Sex.....Social standing.....

Occupation .....Privy.....Clinical form of uncinariasis .. { Very light / Light / Medium / Intense / Very intense

Mazamorra.....Where infected .....

Parasites, (Uncin.) (Ascar. lumb.) (Tric. dispar.).....

Prominent symptoms.....

.....

Complications and intercurrent diseases.....

Course and treatment.....

(Back of the card.)

.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

Observations and intercurrent diseases.....

.....

Result.....Date.....

The patient was given an identification card showing the number of the clinical card and his name. This card read as follows:

PORTO RICO ANEMIA COMMISSION.

STATION AT.....

No..... Date.....

Name.....

Residence.....

As the identification card was often lost, the directors of the stations were advised to keep an alphabetical index of patients enrolled, showing the name and card number of each. So the work was not interrupted by such loss, nor did the patient fail to get his medicine. A new identification card was given to the patients in such cases.

The daily attendance at the stations was recorded on a card showing the number of patients attending for the first time, those returning weekly for treatment, and those who had died or who had been cured. The first named were classified as "admitted" and those once inscribed and now returning weekly as "under treatment."

As some stations had a hospital in connection with the dispensary, the card was divided into two parts, one for the dispensary and one for the hospital service of their station, with the same classification, save that the heading "discharged under treatment" was added for those who were discharged from the hospital but who had passed to the dispensary for further treatment.

This card shows the work of each station at the end of each week and was sent by each director to the central office either on Saturday or Sunday. The data was supplied on a postal card, which also showed the balance of drugs on hand.

The weekly statistical reports forwarded from all the stations were consolidated in a printed monthly bulletin issued by the central office and sent to Government officials, city councils, newspapers, and persons interested in this crusade.

Card kept on file at stations:

PORTO RICO ANEMIA COMMISSION.

Register of patents at the station at.....during the week from.....to.....of .....190...

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.	Total.
DISPENSARY.								
Admitted.....	.....	.....	.....	.....	.....	.....	.....	.....
Under treatment.....	.....	.....	.....	.....	.....	.....	.....	.....
Cured.....	.....	.....	.....	.....	.....	.....	.....	.....
Died.....	.....	.....	.....	.....	.....	.....	.....	.....
HOSPITAL.								
Admitted.....	.....	.....	.....	.....	.....	.....	.....	.....
Under treatment.....	.....	.....	.....	.....	.....	.....	.....	.....
Discharged under treatment.....	.....	.....	.....	.....	.....	.....	.....	.....
Cured.....	.....	.....	.....	.....	.....	.....	.....	.....
Died.....	.....	.....	.....	.....	.....	.....	.....	.....

Remarks.....

.....M. D.,
Director of the Station.

Card sent to headquarters:

PORTO RICO ANEMIA COMMISSION.

Station at..... Report for the week from.....to.....of.....190...

Patients.		Supplies.				
			Balance from last week.	Received during the week.	Supplies consumed.	Balance.
DISPENSARY.						
Admitted.....	.....	Thymol.....	.....	.....	.....	.....
Under treatment.....	.....	Beta-naphtol.....	.....	.....	.....	.....
Cured.....	.....	Caps. No. 0.....	.....	.....	.....	.....
Died.....	.....	Caps. No. 3.....	.....	.....	.....	.....
		Sulph. Soda.....	.....	.....	.....	.....
HOSPITAL.		.....	.....	.....	.....	.....
Admitted.....	.....	.....	.....	.....	.....	.....
Under treatment.....	.....	Remarks:				
Discharged under treatment....	.....	.....				
Cured.....	.....	.....				
Died.....	.....	..... M. D., *Director of the Station.*				

Statement of monthly work, issued by the central office:

PORTO RICO ANEMIA COMMISSION,
OFFICE OF THE CHAIRMAN,
*Rio Piedras, P. R.*_____.

*Number of patients treated at the stations of the Porto Rico Anemia Commission during the month of*_____, 190__.

Stations.	Dispensary service.				Hospital service.			
	Admitted.	Under treatment.	Cured.	Died.	Admitted.	Discharged, under treatment, and referred to dispensary.	Cured.	Died.
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	.....	.....	.....	.....	.....	.....	.....	.....

Following the policy laid down by the commission, each station undertook the teaching of measures to be adopted by patients and the public for the prevention of the disease. The origin of the malady was explained in a clear and simple manner, showing the worms, how they gain access to the human body, where the infection might be contracted, and giving other pertinent information. The same information was printed in a handbill, which was widely distributed throughout the rural districts.

The following is the form of the handbills:

PORTO RICO ANEMIA COMMISSION.

INSTRUCTIONS TO THE PROPRIETORS OF FARMS AND PLANTATIONS CONCERNING THE SUPPRESSION OF ANEMIA IN PORTO RICO.

Anemia is the disease from which the majority of our country folks suffer.

It causes more deaths in the island than all other diseases.

Those peons and others whom you are sheltering and who work for you are not strong men, because they are anemic.

Should they become cured they would be better workmen.

Send them to us that we may cure and teach them to prevent their disease.

To prevent anemia, remember that it comes from ground itch (mazamorra); that ground itch is only contracted where there has been earth soiling; that to avoid ground itch it is well to use shoes.

So advise your dependents and peons.

But it is still more important that each house have its privy, and that no one defecate on the surface of the ground.

Compel your peons defecating while at work in the plantation to cover each stool with a little earth that may be scraped up with their knife (machete).

Thus the excrement is covered and the worms killed.

As soon as the patient was examined, his clinical card filled, and his identification card issued, the director of the station gave him a prescription, which was dispensed by the assistant in an adjoining room. This employee explained to him how the medicine should be taken, and in order to prevent any mistake a printed sheet containing the necessary directions, clearly and concisely explained, was handed to each patient. Furthermore, the paper contained the necessary instructions for the prevention of the disease.

The anthelmintics were administered in gelatinous capsules in two equal doses, the second dose two hours after the first. A purgative was to be taken the night before and another purgative after the second dose of the anthelmintic.

The instructions referred to were printed on colored sheets that read as follows:

ANEMIA COMMISSION OF PORTO RICO.

HOW TO TAKE THE MEDICINES.

Take one of the two purgatives to-night in water.

Take at 6 o'clock to-morrow morning half of the capsules.

Take the other half at 8 o'clock the same morning.

Take the other purgative at 10 o'clock.

You should neither drink wine nor any alcoholic liquor during the time you are taking these medicines.

Come for more medicine until the physician says you are cured.

Have a privy in your house. Do not defecate on the surface of the ground, but in the privy.

Do not walk barefooted, so that you may avoid contracting mazamorra in your feet. Wear shoes and you will never suffer from anemia.

This commission considered, as did the former one, that the work of inspectors visiting house after house throughout the rural districts was the best means for accomplishing prophylaxis.

A special card was printed, to be posted on each house visited by the inspector, so that the residents might not forget the visit. Another card was kept by the inspector as a record of that visit and for the purpose of turning in to the central office data concerning the number of patients in the rural districts and their attendance at the stations.

These cards were printed as follows:

ANEMIA COMMISSION OF PORTO RICO.

SERVICE OF INSPECTION.

Station at _____ Rural district _____
Serial number _____ Date _____
Name of the owner of the farm_____
Residence_____ Kind of farm_____
Name of the owner of the house_____
Inhabitants {male_____ age_____
{female_____ age_____
Do they attend a station?_____ If so, which?_____
Has the house a privy?_____ Remarks_____
_____
References to prove that this service has been performed_____
_____

_____
Inspector.

ANEMIA COMMISSION OF PORTO RICO.

Certificate of inspection performed by_____, inspector for the district of _____, on the _____ of _____, 190__, said inspector having given to the residents the following advice:

People living in this house must not defecate on the ground, but in privies.

By doing so the mazamorra will not exist in the environments of the house, nor on farms, nor in roads, because mazamorra is only found in the places where people defecate. If there is no mazamorra, there will be no sufferers from anemia, because the worm producing this disease is the same mazamorra which makes its way into the intestines.

Try to wear shoes and you will not get mazamorra in your feet.

The importance of this inspection service was from the first realized by the commission, but it was not possible to extend it to each station, because we were not prepared to meet such a considerable expense. For this reason it was carried on only at the three principal stations.

The work of the inspectors at Rio Piedras, Mayagüez, and Lares induced many patients who had given up treatment to return to the stations. Many who had been undecided heretofore also came to be treated, and many privies were built in the rural districts.

The number of houses visited by these inspectors was 1,846 in Rio Piedras, 1,906 in Mayaguez, and 1,807 in Lares.

In accordance with the division that had been adopted, the commission gradually began to establish a larger number of stations.

Work was begun at the central station, Lares, Guayama, Coamo, San German, and Vega-Baja in July; at Mayagüez, Aibonito, Utuado, Morovis, and San Sebastian in August; at Bayamon, Corozal, Juncos, Manati, Comerio, Las Marias, and Isabela in September; at Yauco, Ponce, Quebradillas, Barranquitas, and Barros in October; at Humacao in November; at Añasco, Caguas, and Arecibo in December; at Arroyo in January; at Cabo-Rojo and Cayey in February; at Vieques and Aguada in March; at Aguadilla in April; at Adjuntas and Fajardo in May; in all, 35 stations, whose statistical reports are published in this book. The gradual opening of stations made it possible to carry on the work all over the island, for had all stations been opened at the same time it would have been impossible to continue throughout the fiscal year. As a matter of fact, the greater number only worked during a portion of that year.

The directors of the dispensaries at Manati, San Sebastian, and Quebradillas extended their work to near-by towns; the director of the first visited Ciales and Barceloneta; that of the second, Moca; and

that of the third, Camuy. None of these physicians received additional pay for their extra labor.

The employees at each station and their salaries were as follows:

Stations with hospital service (Coamo, Guayama, Ponce, San German, Utuado, Vega-Baja).

	Annually.
One physician, director	$1,000
One assistant	360
One nurse	120
One peon	72
Total	1,552

Stations with dispensary service only.

One physician, director	$720
One assistant	240
One peon	60
Total	1,020

Some stations began to operate without great expense shortly after the creation of the commission, because their directors rendered their services free of charge. Such was the case at Bayamon, Barranquitas, Morovis, Isabela, Quebradillas. At the Aibonito station the Porto Rico American Tobacco Co. paid the salary of the physician on account of the great number of workingmen suffering from uncinariasis employed on their plantations and treated in the dispensary at that town. The commission had only to pay the assistant and peon at these stations.

During the last six months of the fiscal year the directors of those stations who for the first part of the year had done their work without pay received the same salary as that paid the others. The only exception made was in the case of Dr. Stahl, the venerable director of the Bayamon station, who, being already an officer of the people of Porto Rico, could not under existing laws receive additional pay.

Dr. Garcia Lascot, of Arroyo, also rendered his service free of charge, due to the fact that when his station began to operate the entire allotment on our budget had already been assigned to preexisting stations, and there were no funds from which to draw to cover his salary.

In the organization of the campaign against uncinariasis in Porto Rico the commission necessarily found serious difficulties, which in the majority of cases were overcome by the good will of the municipal authorities and the directors of stations. Both authorities of the towns and physicians felt themselves in duty bound to make a thorough study of the problem, and realized the great benefits to be derived from the cure of a people whose principal source of wealth is agriculture.

They were in a position to see to what extent this disease weakens the organism, wastes energy, reduces the chance of success in the struggle for life, and slowly but surely leads to misery and ruin a race that should be the strong and sustaining arm of the island.

RESULTS OF THE CAMPAIGN OF 1906–7 AND ITS IMPORTANCE.

At the close of the fiscal year 1906–7 the 35 stations of the island had examined and treated 89,233 patients suffering from uncinariasis.

The commission deemed it wise to prepare general statistics covering certain important points, such as the residence of patients, sex, age, the results of treatment, etc. Therefore a circular was addressed to the several offices requesting the preparation of forms showing the work done, models containing necessary explanations being sent at the same time.

As the work of enrolling new patients and treating those already enrolled could not be discontinued, the preparation of these statistics considerably increased the burden of the directors of the stations, who had to make great efforts to fully perform their duties.

The forms prepared by these officials contain the following classification:

Form No. 1.—Number of patients enrolled at each station, and classified according to residence.

Form No. 2.—This sheet was prepared at the central office and is the record of the weekly visits of patients to each of the stations.

Form No. 3.—Classification of the total number of patients according to residence, showing age and sex.

Form No. 4.—Results of treatment according to the age of patients.

Form No. 5.—Relation between treatment and the clinical type of the disease.

The summary of Form No. 1 shows the number of patients classified as to their residence, but without reference to the station where they were enrolled.

Number of patients according to their place of residence.

Adjuntas	2,184	Loiza	21
Aguada	1,142	Manati	2,157
Aguadilla	1,246	Maricao	79
Aguas Buenas	89	Maunabo	2
Aibonito	2,338	Mayagüez	3,901
Añasco	3,511	Moca	2,163
Arecibo	2,555	Morovis	3,325
Arroyo	291	Naguabo	49
Barceloneta	1,531	Naranjito	517
Barranquitas	1,129	Patillas	145
Barros	1,872	Peñuelas	9
Bayamon	956	Piedras	384
Cabo Rojo	2,542	Ponce	1,454
Caguas	139	Quebradillas	1,223
Camuy	2,294	Rincon	7
Carolina	522	Rio Grande	14
Cayey	1,669	Rio Piedras	2,310
Ciales	1,639	Sabana Grande	1,060
Cidra	803	Salinas	21
Coamo	1,336	San German	6,103
Comerio	1,242	San Juan	315
Corozal	2,364	San Lorenzo	183
Dorado	156	San Sebastian	2,331
Fajardo	191	Santa Isabel	16
Guayama	1,106	Toa Alta	458
Guayanilla	408	Toa Baja	8
Gurabo	253	Trujillo Alto	320
Hatillo	722	Utuado	4,444
Humacao	2,641	Vega Alta	498
Isabela	2,218	Vega Baja	2,197
Juana Diaz	139	Vieques	801
Juncos	1,554	Yabucoa	123
Lajas	1,637	Yauco	1,558
Lares	4,464		
Las Marias	2,154	Total	89,233

It may be easily seen that, although there were only 35 stations operating in the island, the patients represented all the towns in Porto Rico, a fact which shows the faith of all the people in the work and their dire necessity for cure.

The commission tried to place the stations in such a manner as to make it possible to extend their benefit to surrounding towns, but so limited a number could not fully attend to so thickly a populated area. Nevertheless the desire to be cured is so great among the peasants that they come from the most distant rural districts for medicines. No distance is too great for them, and it is marvelous to see them tramp over villainous paths, leaving their homes at midnight in order to reach the station at sunrise.

The fact that there is a much greater number of applicants than we were able to treat is ample proof that there should be at least 50 stations, so located as to cover the greatest possible area.

No sooner was a station established than numbers of people hastened to receive treatment, thereby proving the necessity for a permanent station at that point. Whenever the attendance was small the salaries of the employees at such station were stopped; medicines and recording cards were, however, sent gratis for use by the regular municipal physician.

The attendance at each station is recorded in the following table:

Total number of visits of patients to the stations.

		Number of weeks.	Number of patients.	Number of visits.
1	Lares	52	5,128	25,598
2	Guayama	52	1,210	3,441
3	Coamo	51	1,418	10,833
4	San German	50	9,414	46,265
5	Vega Baja	50	2,819	19,333
6	Rio Piedras	49	3,684	14,189
7	Mayagüez	48	3,821	17,717
8	Aibonito	48	3,647	18,261
9	Bayamon	46	820	2,245
10	Morovis	45	3,270	11,924
11	Juncos	44	2,417	10,731
12	Comerio	43	1,525	9,215
13	San Sebastian and Moca	43	4,222	20,523
14	Corozal	43	3,304	17,536
15	Manati, Barceloneta and Ciales	43	5,279	28,598
16	Utuado	42	4,497	16,400
17	Isabela	40	2,595	10,875
18	Ponce	39	1,464	5,725
19	Yauco	39	1,880	5,583
20	Quebradillas and Camuy	39	4,003	12,424
21	Barros	38	1,821	10,977
22	Barranquitas	38	821	3,633
23	Las Marias	38	2,144	15,127
24	Humacao	35	2,786	18,617
25	Añasco	30	3,629	20,297
26	Arecibo	28	2,433	12,436
27	Arroyo	23	336	1,603
28	Caguas	21	129	378
29	Vieques	19	801	4,010
30	Cabo Rojo	19	2,165	9,097
31	Cayey	18	1,547	7,854
32	Aguada	14	999	3,962
33	Aguadilla	11	1,031	3,459
34	Adjuntas	8	2,008	5,741
35	Fajardo	6	196	439
	Total	.....	89,233	425,131

Total number of visits of patients to the stations—Continued.

Age.	Male.	Female.	Total.	Percentage male.	Percentage female.	Percentage of 89,219 patients.
Less than 5 years	572	401	973	58.79	41.21	1.09
From 5 to 9	4,406	3,534	7,940	55.49	44.51	8.90
From 10 to 14	9,952	8,605	18,557	53.63	46.37	20.80
From 15 to 29	16,127	17,288	33,415	48.26	51.74	37.45
From 30 to 49	11,622	9,926	21,548	53.94	46.06	24.15
Over 49	3,746	2,938	6,684	56.04	43.96	7.49
Not classified	61	41	102	59.80	40.20	.12
Total	46,486	42,733	89,219	52.10	47.90	100.00
Lost cards (Afiasco)			14			
			89,233			

This abstract clearly shows the zeal of the directors of stations.

When it is borne in mind that 89,233 patients have required 89,233 preliminary examinations, in order to accurately diagnose their disease; when it is remembered that these examinations consist of a microscopic examination of the patient's feces; when it is considered that these examinations have been repeated weekly throughout their treatment; that the name of each patient had to be entered on a card, as well as the history of his disease; that the dose of medicine had to be prescribed him, his card of identification issued, and a handbill given him explaining the cause and means of prevention of the disease; in short, when one pictures the daily throng of patients at the station, then only will the crusade of our country doctor be fully appreciated.

The total number of visits here recorded is 425,131, exclusive of those made by the 22,396 cured patients at whose last visit no ova of uncinaria were found. The total number of visits to stations may be estimated at about 500,000, and this demonstrates not only the great faith of our peasants, who thus respond to the efforts of those who are working for the betterment of their physical and sanitary condition, but also in still higher degree the altruism of the physician and his assistants who have carried on this arduous labor at so insignificant a cost. After studying similar work undertaken in other countries we are in a position to assure our readers that no physician elsewhere would have treated so many patients for so miserable a salary. Calculate the fees of an expert for each visit, including a microscopic examination, and then think what the cost of half a million would amount to!

Number of patients arranged according to age and sex:

This abstract shows that 52.10 per cent of the patients were male and 47.90 per cent female. The greater number of male patients is due to their greater exposure to infection.

However, if we make a comparison between men from 15 to 29 years of age and women between the same age limits, we find that the number of the latter is 17,288, or 51.74 per cent, and that of the former 16,127, or 48.26 per cent.

To explain this excess of 3.48 per cent females over the males, it must be borne in mind that the greater number of our stations have been operating in towns of the interior, where a great many women are working on coffee plantations.

There are more patients in the age period 15 to 29 years than at any other—33,415, or 37.45 per cent of the entire number.

These figures are very disheartening, as they show that the young are most afflicted by the worm that, according to Thornhill, in referring to the epidemic of ankylostomiasis in Ceylon, causes more serious ravages than cholera, not on account of the number of deaths, but on account of the vast numbers affected, the chronic nature of the disease, and the aggregate mortality—direct and specially indirect—for which it is responsible.

And when in statistics that only show the results of work done in an average period of eight months, the number of patients attending at the station is so great it becomes evident that the most virile part of our population is seriously threatened. Those between the ages of 30 and 49 years give a percentage of 24.15 per cent of the total number. Thus there were 54,963 patients between 15 and 49 years of age, or 61.60 per cent. The group giving the smallest contingent of patients is that composed of children under 5 years, those between the ages of 5 and 9, 10 and 14, and adults of 50 years and upward. The proportion of cases occurring among children is 30.79 per cent; that among young and middle-aged adults, 61.60 per cent; and that among the old, 7.49 per cent.

The last two tables show the result of the treatment in five classifications:

1. Cured. 2. Practically cured. 3. Under treatment. 4. Ceased to return. 5. Died.

Results of treatment according to the age of patients.

Result.	Less than 5 years.	Percentage.	5 to 9, inclusive.	Percentage.	10 to 14, inclusive.	Percentage.	15 to 29, inclusive.	Percentage.	30 to 49, inclusive.	Percentage.	Over 49.	Percentage.	Age not recorded.	Percentage.	Total.
Cured	213	0.93	2,010	8.76	4,818	21.01	8,011	34.93	5,876	25.62	2,008	8.75	....	....	22,936
Practically cured	183	1.18	1.428	9.21	3,395	21.89	5,919	38.17	3,483	22.47	1,099	7.08	....	....	15,507
Under treatment	328	.91	3,284	9.09	7,613	21.07	13,758	38.08	8,665	23.98	2,384	6.60	100	0.27	36,132
Ceased to return	241	1.67	1,201	8.31	2,708	18.74	5,667	39.22	3,466	23.98	1,166	8.07	2	.01	14,451
Died	8	4.15	17	8.80	22	11.40	61	31.61	58	30.05	27	13.99	....	....	193
Total	973	1.09	7,940	8.90	18,556	20.80	33,416	37.45	21,548	24.15	6,684	7.49	102	.12	89,219
Lost cards at Añasco	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14
Grand total	....	....	....	....	....	....	....	....	....	....	....	....	....	....	89,233

Results compared with the clinical type of uncinariasis.

Clinical type.	Cured.	Percentage.	Practically cured.	Percentage.	Under treatment.	Percentage.	Ceased to return.	Percentage.	Died.	Percentage.	Total.	Per cent of 89,219.
Very light	1,856	26.20	1,769	24.97	1,981	27.96	1,478	20.86	1	0.01	7,085	7.94
Light	4,720	24.20	3,622	18.57	8,215	42.12	2,943	15.09	3	.02	19,503	21.86
Medium	10,073	26.21	6,229	16.20	15,597	40.58	6,503	16.92	37	.09	38,439	43.08
Intense	5,113	26.61	3,019	15.71	8,273	43.06	2,739	14.26	68	.36	19,212	21.53
Very intense	1,048	25.18	762	18.31	1,639	39.38	629	15.11	84	2.02	4,162	4.67
Not classified	126	15.40	106	12.96	427	52.20	159	19.44	....	....	818	.92
Total	22,936	25.71	15,507	17.38	36,132	40.50	14,451	16.20	193	.21	89,219	100.00
Lost cards at Añasco	....	....	....	....	....	....	....	....	....	....	14	....
Grand total	....	....	....	....	....	....	....	....	....	....	89,233	....

Under the first heading are grouped patients who, after having regularly attended a station, ceased to expel ova in their feces and whose blood was restored to normal, as demonstrated by the hemoglobinometer or by the careful examination of the conjunctivæ and other mucous membranes.

Practically cured.—Patients so termed are those who, having attended a dispensary on more than four occasions, and having taken an equal number of doses of the anthelmintic, gave up treatment for a period of time longer than three months.

We consider these cases to be practically cured for the following reasons:

1. They represent the milder forms of the disease.
2. Five doses of an anthelmintic cause the expulsion of a great number of parasites, causing the most troublesome symptoms to disappear, and thus restoring the blood to its normal.

The expulsion of the great majority of the parasites by means of these four doses was a fact ascertained by the experimental work of the first commission, and we have found practically the same thing on repeating these experiments.

Patients thus classified are cured as far as their ability to return to their daily work and the disappearance of troublesome symptoms are concerned, and this classification is for the purpose of insuring consistent statistics.

Under "Ceased to return" were all patients who took one or two doses of medicine and who did not return to the station for the next three months at least.

The heading "Under treatment" covered all cases recorded up to June 30 and not included under other headings.

Instructions were given to classify under the heading "Died" only such deaths as might result from uncinariasis or some of its complications, but many stations included deaths occurring from intercurrent diseases. Thus, the death rate is greater than it should be, although, even as it is, the number of deaths is insignificant.

The anthelmintics administered were thymol and beta-naphthol, a purgative of sodium sulphate being given before and after.

As a tonic, Blaud's 30 centigram compressed tablets were used. These were more often employed to induce patients to continue the regular treatment, as it sustained their interest.

The complete cure of the disease was effected in 25.71 per cent. The practical cure, as explained, was obtained in 17.38 per cent of the cases. Therefore, it may be asserted that 43.09 per cent of our patients were cured of the disease.

Although in accordance with the strict application of rules of science and statistics, those who took one or two doses of the anthelmintic have been classed among patients who discontinued treatment, it must be borne in mind that the condition of such patients was vastly improved after having expelled 76.85 per cent or 72.24 per cent of their parasites when one dose of thymol or beta-naphthol, respectively, was taken. If they took two doses of thymol they expelled an average of 92.39 per cent of their parasites, and if two doses of beta-naphthol 88.12 per cent were expelled. Although not completely cured, these people received great benefit and the infestation of the ground was consequently decreased. Taking it for granted that they continued to live in the same unsanitary conditions as ever,

after such a great elimination of parasites the remainder would produce but a limited number of ova, and the danger of infection was thus considerably diminished.

The number of deaths is very small in spite of the fact that under this head were classed many patients who did not succumb to uncinariasis. The deaths occurring from anemia have notably decreased, although the majority of stations did not operate throughout the entire year.

Those who have been most constant in keeping up the treatment have been sufferers from very intense forms of the disease, a proof that the chronics in the last stage of the disease, after taking the first dose of medicine, experienced relief that no other drug had hitherto afforded them, and their faith and confidence stimulated them to be punctual in their periodic visits to the stations. It should also be stated that these patients came from the most distant rural districts and were extremely poor.

In summing up the results of treatment, we have:

	Per cent.
Cured and practically cured	43.09
Condition bettered	16.20
Under treatment	40.50
Died	.21

There is an important point in connection with the treatment of the disease which is being discussed by both professional men and the laity, and that is the possibility of patients being subject to reinfection after having been cured.

It is not our intention to assert that a man who has been cured of this disease is forever after rendered immune to its influence. It is enough to state that any opinion whatever on the subject of reinfection in uncinariasis is premature.

We must study the two elements necessary for contracting the disease.

It is true that our peasant, once cured, returns to infested localities, because he earns his livelihood in such places. But it is also true that a man after being cured knows how to prevent infection, is acquainted with what was formerly unknown to him, and can realize that when he has mazamorro the larvæ of uncinaria have penetrated his skin. Furthermore, he knows the specific places in which mazamorra may be contracted.

We do not pretend to say that this is a rule without exception. Many who are to-day cured will be reinfected to-morrow, and in such a labor extermination of the disease is yet problematical; but this is no argument against teaching and curing as carried out in our stations, nor does it destroy our hope in the ultimate success of our campaign, the elimination of uncinariasis as an economic and social plague.

The data gathered at those stations which were opened as an experiment during the past fiscal year, and which have been operating for two years, are the best argument as to the permanent state of health enjoyed by the patients who have been cured. In Aibonito, where the commission was working in 1905 and had 6,152 patients suffering from uncinariasis under treatment, 3,647 more were enrolled in the following year, making a total of 9,799. Only 15 persons were reinfected from 1905, according to the reports of that office.

At the Utuado station, where the first commission began its investigations, 4,543 patients were treated in 1904, 1,830 in 1905, and 4,497 during the fiscal year 1906–7, making a total of 10,945 patients. Nine hundred and ninety-eight already cured returned to be examined, and only 42 of them had become reinfected. The station at Lares, open since the beginning of the campaign, and having registered more than 13,000 patients, reports a very small number of reinfected. This statement also holds good for Coamo, Barranquitas, Barros, and others. Although we may consider the number of reinfected underestimated, and it is certain that more have again contracted the disease and have not returned to the stations for renewed treatment (due to the fact that they did not experience such serious inconvenience as that suffered in the past), this clearly demonstrates that former patients who really have been reinfected are only lightly infected, and that reinfections due to patients not following the teaching received at the stations are not to be greatly feared. This does not mean that by the sole efforts of the stations we shall succeed in suppressing uncinariasis in Porto Rico. For this purpose we must adopt other means, which we shall later consider.

NOTES ON CERTAIN TECHNICAL STUDIES.

The investigations carried on by the commission for a period of two years, the private investigations of each individual member of the commission, and those of other physicians of the island who were studying the matter, always led to the conclusion that the parasite was the same described by Stiles, and that the parasite existing in the Old World had not been found native to this island. However, it was considered reasonable to suppose that this parasite did exist here, because European immigration must have brought to this island the species found by Dubini. In effect, two persons had been found in Porto Rico who probably secured their infection in Europe, as seen from a previous report.

While Dr. Gutierrez was studying at Rio Piedras the anthelmintic effect of eucalyptol and examining the worms expelled, he discovered that the parasites found in case No. 2234, E. L., male, age 20 years, colored, born at Santurce and a resident of that district, who had never left the island and was suffering from severe uncinariasis, were of a different size from those seen heretofore. His experience, covering more than 80,000 worms collected by the first commission in addition to those found in other personal investigations, caused him to see immediately that those expelled by this patient did not belong to the ordinary type. He then prepared the parasite for a more thorough microscopic observation, and comparing it with the description given by Loos (Records of the Egyptian Government, 1905) and with the fine lithograph engravings accompanying this valuable monograph, he was able to demonstrate that this parasite was of the typical species *Ankylostoma duodenale* of the Old World.

Therefore the propagation in Porto Rico of this species is evident.

Some time later, when the Medical Association of Porto Rico held its scientific meeting at Ponce, in June, 1907, Dr. Gutierrez drew its attention to specimens of this parasite, and showed that its charac-

teristics were different from those of *Necator americanus*. To Dr. Gutierrez is due the priority for discovery of the Old World species in a Porto Rican never out of this island.

* * * * * * *

TREATMENT.

The anthelmintics used by the commission at all the stations were thymol and beta naphthol, and the method of administration was that described in the report for 1904.

All the directors of stations agree in considering thymol a more powerful anthelmintic than betanaphthol, and a drug without poisonous effects. As a matter of fact, few patients are treated in our hospitals; the great majority carried their medicines to their homes where they take them in accordance with our directions, but a complete check system would have immediately revealed cases of poisoning had there been any.

Our experience with eucalyptol in a few cases does not permit us to advise the use of this drug, so highly lauded by Phillips. The cases treated by it at Mayagüez, Rio Piedras, and Lares, were hospitalized and Phillips's formula was employed:

	Grams.
Eucalyptus oil	2.50
Chloroform	3.50
Castor oil	40.00

In the 14 cases treated at Rio Piedras the results were as follows: One expelled after the first dose more than 1,000 uncinariæ; one, 500; three, 400; one, 200; one, 90; one, 40; one, 20; two, 10; one, 5; one, 2; one, none. One expelled more than 200 uncinariæ after the second dose; one, 100; two, 50; two, 30. The remainder would not take the second dose of the medicine. One expelled 42 uncinariæ after the third dose; one, 8; two, 3; one, 2; one, none.

The medicine was administered every two days, the dose being divided into three equal parts, and one dose taken every 20 minutes, the intestines of the patient having been previously emptied by means of a purgative. All the patients suffered from dizziness, fatigue, and a desire to sleep, and in some vomiting, in others syncope was produced, making it necessary to administer stimulants to prevent a fatal result. Similar results were obtained in experiments made at Lares and Mayagüez.

This drug, which proved effective in the hands of others, has not given satisfactory results in our practice, and, without inferring that its anthelmintic power is inferior to that of thymol and beta-naphthol, our experiments enable us to state that it is dangerous, not easily administered, costly, and unfit to dispense in this country where the peasant has to carry his medicine a long distance from the stations. Patients in the hospital objected to taking this remedy, and being unable to keep them under treatment long enough for them to expel all of the parasites, we were afraid of its effects, when they were not under our direct observation. When patients desired to continue treatment we made use of thymol. Nevertheless, the use of eucalyptol affords the great advantage of enabling us to secure living parasites.

The greater part of the worms expelled by our cases through this treatment were gathered alive from the feces and kept so in a normal

salt solution for about 48 hours, and for this reason eucalyptol is used in preference to other drugs when the living parasite is desired for anatomic investigations and hemolysis experiments.

FERRUGINOUS MEDICATION.

The commission, as well as all the directors of stations, believe that ferruginous preparations are unnecessary for the cure of anemia due to uncinariasis. It is only by the expulsion of the parasites that the increase of the blood corpuscles and hemoglobin is obtained. A tonic and stimulant, acting upon the cardio-vascular apparatus, and needed in the acute and very acute cases, is far more effective than such preparations, for before the regeneration of the blood has begun, cardiac troubles, aggravating the condition of the patient, demand an active remedy.

The prescription of ferruginous preparations, however, is very desirable for a totally different reason; their use acts as an incentive to patients who feel that to be under treatment they must be taking medicines. This is why we usually employ Blaud's 30-centigram compressed tablets.

EDUCATION IN PROPHYLAXIS AND LAWS NECESSARY FOR THE SUPPRESSION OF UNCINARIASIS IN PORTO RICO.

Of the two paths open to invasion of man by the parasite, the oral and the cutaneous, we believe that the latter offers an easier access to the larva, given the direct contact of the bare feet of our country people with the infective embryos in the great breeding grounds of Porto Rico, the coffee and banana plantations, the surroundings of the hut, etc. Nevertheless, it is impossible for us to rotundly deny that in some occasions larvæ may reach the intestine by the oral route—muddy water, fruit, vegetables, etc., serving as vehicles.

The prophylaxis of this disease, therefore, will have to be individual as well as general, and should be directed toward—

1. The destruction of mature worms in the intestine of worm carriers as well as of the worm sick, in order to avoid the renewal of the culture in the earth by eggs which may develop into infective larvæ. The cure, therefore, of carriers and persons already ill of the disease.

2. The proper disposal of feces to avoid the indefinite multiplication of foci of infection.

Construction of privies, permanent and portable.

3. The protection of the individual whose life obliges him to come into direct contact with infested soil.

Personal hygiene and the use of shoes.

Now, in order to make this plan for prophylaxis effective, it is absolutely necessary to incorporate in the popular mind the knowledge of the cause of this pandemic and to inculcate in the man by education and incontrovertible proofs afforded by an active and persistent propaganda, a realization of the danger that menaces him and a familiarity with the means at his disposal for his self-protection.

The commission has followed the plan of treating the sick from uncinariasis in the past, and will continue to do so in the future, on account of the peremptory necessity of freeing people, without resources and without means of extricating themselves from their di-

lemma, of a parasite which slowly claims more and more of their strength. But with all this, prevention of the disease is forwarded. As a matter of fact, the commission, upon curing an individual of his disease, expels from his intestinal canal the females, which are a never-failing source of ova that later develop into innumerable infective embryos, and thus the community is freed of one more source of contamination, even though, in spite of our best endeavors, the same person should continue to soil the earth as before.

Treatment of our sick country people has, therefore, two practical results—it cures them of their disease and it renders them incapable of propagating it to others.

This is the object pursued by our stations, aside from the very important one which provides for the education of the patient in personal hygiene. But our mission does not end here. It is our duty to watch that the foci of infection may never again become active and to provide that means be given the individual to defend himself against reinfection at all times throughout an indefinite future.

The sterilization of foci of infection by physical or chemical means is not feasible. The experiments carried out along these lines in mines have usually given negative results on account of the tenacious resistance offered to these agents by the larvæ; and this was in the limited confines of a mine. Therefore there is but one way to exterminate these foci, given the biologic characteristics of the parasite, and that is to let them die out, meanwhile avoiding the restocking of the earth by ova-laden feces. Otherwise the culture grounds will be eternal.

In order that the individual may be protected as long as the earth remains infested with larvæ it becomes necessary that he receive some sort of prophylactic education. This is a matter for the public-health service to provide on the one hand and for the individual to put into practice on the other. Let us see how much education and propaganda can do toward securing these ends:

The teaching of the cause of uncinariasis and its mode of propagation should begin in the school, as this is a disease which respects neither age nor sex. The child should know the danger he incurs when he deposits his excrement here, there, and everywhere; when he fails to wash his hands before eating; when he eats fruit not previously cleansed by washing; when he walks barefooted in places where the seed of the disease is likely to be sown. This instruction, alone or combined with a course in the elements of personal hygiene, is needful in order to form a generation that will rise with the habits of cleanliness which insure good health.

We propose, therefore, that in every school in Porto Rico, and with especial care in the rural schools, one hour of each week, each two weeks, or even each month be set aside for this purpose. This was the object of a resolution passed by the Medical Association of Porto Rico; it was adopted by the commission, and ought to be put into practice by the department of education. We also believe that to better fix the attention of the child upon the danger which menaces him each school should have displayed in a prominent place colored pictures of the worm, of the places it chooses for its culture ground, and of a sick and a well child, side by side, pointing out the manner of avoiding the disease. In this manner a graphic description would awaken the children to a lively interest in so vital a mat-

ter for their health; but such pictures should also contain such rules of hygiene as everyone should know.

Similar graphic instruction could be resorted to where a large number of laborers are employed on the more important plantations, in factories, in private educational and charitable institutions, and wherever the adult may be taught the danger threatening him and how to avoid it.

Our stations should have an inspector to visit the rural districts, to seek the sick, and to stimulate those under treatment to continue and spread the knowledge of the benefits to be derived from the observance of hygienic laws.

The law is not the instrument best fitted to instruct a man to be clean, to live up to the rules of hygiene. Legislation concerning such matters would lie dormant in the statute books until the people learned to appreciate the spirit that prompts such measures. This is why we urge teaching in schools and other methods of propagating a knowledge of the fundamental principles of hygiene. Laws governing such matters will follow in time, when they have the firm support of an enlightened majority who themselves constitute the best police for their enforcement.

However, a sanitary ordinance providing for the erection of privies on farms should be energetically enforced in every municipality where there is a station. The use of portable privies in plantations where it is impossible to construct permanent ones should be required of every farm owner giving work to a certain number of laborers.

Basing our petition on the practice followed in certain mines in Europe where this disease caused serious damage, we requested the governor to require the commissioner of interior to oblige the laborers employed on public works, in building roads, etc., to use the portable privies, which the contractors of the work should be forced to supply. This measure should be enforced by law.

We are, moreover, of the opinion that this law should be given a wider scope and made to cover another very important factor in the spread of the disease, namely, the compulsory wearing of shoes by every workman or laborer in the employ of the people of Porto Rico.

The workman who wears shoes for some time does not abandon the custom as easily as might be supposed. There is an anatomic reason that prevents him from doing so; the use of shoes causes his foot to shed the horny layer which forms a natural protection for his bare feet and which is developed by going completely barefooted, and when this crust disappears he is obliged to wear shoes to protect his now tender feet. And to better insure a complete prophylaxis, if the workman is required to show a certificate to the effect that he has been cured or is free from the parasites, then as a result of the combined effects of the treatment given at our stations of propaganda and of the provision of law described, uncinariasis would in time cease to be the chief disease of our people.

From the foregoing statements it is clear that the campaign against uncinariasis in Porto Rico should be supported and continued as follows:

1. There should be at least 50 stations for the treatment of patients and for the propagation of information concerning the disease, each having a sanitary inspector to superintend the rural districts. For the support of these stations an appropriation of $100,000 is needed.

2. Objective teaching concerning the disease and its prophylaxis should be obtained in every public school, where illustrated pamphlets giving a vivid idea of the disease should be furnished to children for them to carry them to their homes, thereby contributing to the diffusion of knowledge with regard to uncinariasis.

3. Active propaganda, the efficiency of which should be assisted by the use of handbills, printed bulletins, and notices, comprehensively and graphically illustrating the subject under discussion, should be resorted to in the great labor centers, in factories, and workshops, and on plantations, etc.

4. Sanitary regulations should be promulgated, compelling the installation of privies in every place of abode, and especially on plantations and localities where a large number of workmen assemble.

5. Legal measures should be adopted enforcing the wearing of shoes and the use of portable privies by all laborers employed by the government of Porto Rico.

6. Laws should be enacted prohibiting persons suffering from uncinariasis from employment in public work under the government of Porto Rico, and requiring the presentation of a certificate by applicants showing them to be free from infection.

We are perfectly aware that in such campaigns as this, conducted for the benefit of the individual, as also for that of society in general, the liberty of the citizen appears to be threatened; but if the system of teaching we suggest is carried out, and the patient cured, there will be no cause whatever for complaint, because the immediate advantages resulting from this crusade will be experienced by each one and will convert him into a conscientious worker for the physical redemption of his own people.

EXPENSES OF THE CAMPAIGN FOR FISCAL YEAR 1906–7.

The expenses of the commission during the fiscal year 1906–7 are as follows:

Laboratory and furniture	$2,042.73
Salaries	35,902.62
Medicines	5,650.43
Printing	978.56
Miscellaneous expenses	284.59
Traveling expenses	762.50
Hospital expenses	1,712.92
Postage and telegraph expenses	201.38
Transportation	511.85
Warrant issued to the War Department in payment of supplies	168.73
Total	48,216.31

The laboratory expenses cover the purchase of microscopes for the central station, for those of Lares and Mayagüez and for such others as were provided with them until the municipalities acquired these instruments; also of material for the laboratory for the central station, including hemoglobinometers, hematocytometers, etc., sent to several stations, slides and cover slips for microscopic examinations, and other apparatus needed for microscopic investigation.

Under hospital expenses are included subsistence for patients in a serious condition admitted at Rio Piedras, Mayagüez, and Lares, there being 9,990 patients fed at an average cost of 17 cents per capita.

Payment was made to the War Department for hospital material, loaned to this commission by its predecessors, which was lost or destroyed.

The other items are self-explanatory.*

With the sum of $48,216.31 we have treated 39,233 patients, which represents an expenditure of 54.03 cents per capita.

If this per capita be subdivided under three principal headings, it makes the following showing:

	Cents.
Salaries	40.23
Medicines	6.33
Sundries	7.47
Total	54.03

When identical work was carried on in the mines of Bochum (Germany) the physicians were paid at the rate of 2 marks for the three examinations to which every workman had to submit before being admitted.

The cure of patients was effected in barrack hospitals by other physicians, and each miner was cured at the cost of about 80 marks.

If we compare these data with those of our campaign, we may see that the work alone of examining our 89,233 patients who made 500,000 visits would have cost more than $79,000, paying the physicians at the rate of 2 marks for each three consultations. We also realize the fact that the per capita cost is trifling when compared with that of Bochum, although we must take into consideration that the patients have not been attended in hospitals here.

The balance of medicines on hand June 30, 1907, as shown on the reports received from the stations up to that date has a money value of $2,003.08.

Up to that date bills covering our last orders from the United States had not been received, as the firms supplying the goods always delay a good deal in sending them. These bills, amounting to a little over $900, form the debit of the commission at the close of the fiscal year.

Our final balance can be summed up as follows:

Payments up to June 30	$48,216.31	Appropriation	$50,000.00
Bills pending payment	900.00	Medicines	2,003.08
	49,116.31		
Superabit	2,886.77		
Total	52,003.08		52,003.08

[It is impossible for lack of space in a compilation of all of the reports of the anemia commissioner and its successor, the anemia dispensary service, to include the valuable and interesting reports of the physicians in charge of each of the stations during this year which were addressed to the president of the commission. But it is of extreme value in corroboration of what we have already set forth in the body of this work to quote certain parts of these letters, and to thus reflect conditions confronting our medical officers in the various towns where dispensaries are working.

The translations have, of necessity, been liberal, but the sense is not at all altered. The reports of these physicians represent the criterion of practitioners of all ages, from the young man hardly out

of college to the venerable and beloved "family doctor." It has been the ambition of all of the directors of this work to enlist the sympathy and utilize the services of all physicians, thus confiding the delicate mission of eradicating false conceptions of a widespread disease to the country doctor, whose word is believed and who is respected in the community in which he lives. And wonderful results have followed this policy. Men who in the richness of their years have accumulated vast knowledge of the human side of the jibaro have caught the enthusiasm of this work and, young again, are veritable evangelists for hygienic reforms, upon which we are hoping to build our permanent results.]

STATION AT ADJUNTAS.

A goodly number of persons that could not walk to the station and who had been brought here in hammock or on horseback we have seen come afoot a few days after they have taken the medicine, and they have told us that they could work, provided this work were not too excessive for their strength. Well can it be said that these individuals have been saved from a near and certain death!

For these and other reasons we can attribute the earnestness with which our country people have sought our stations looking for the remedy they knew would cure them and traveling by night over vile paths in order to be the first to receive their medicine. There are no arguments more convincing than the things we see. They had seen the result of treatment in their neighbors and had believed.

Thus it will be explained how in only eight weeks, which is the time that this station has been in operation—and let it be understood that we had two interruptions to the work on account of lack of medicine, which influenced a great many in not coming—the number of our patients has reached 2,008.

I believe that the benefit which the working class has received is immense and that proprietors of plantations partake in this benefit. The propaganda of educating workingmen to practice the rules established for the purpose of escaping reinfection is a duty which rests upon the owners of these plantations, because they, in contact as they are with their laborers, can enforce these rules better than the police.—[Dr. Celso Caballero.]

STATION OF AGUADA.

If we compare the statistics of death of former years, we obtain the following information, which speaks very loudly for the benefit received from the stations of anemia by our people.

During the years 1904 to 1905, 1905 to 1906, and 1906 to 1907 there has been a gradual diminution from 30 to 7 per cent of deaths from anemia.

From all that I have said we can deduce the following conclusion: That the stations of anemia ought to be preserved in our island for a reasonable time for the benefit of our population which, due to anemia from uncinariasis was decreasing in a most notable manner.—[Dr. Juan Garriga.]

STATION OF AGUADILLA.

We know very well that the entire rural population, as well in the high portion as in the sandy parts of our island (for it is very rare that one does not suffer from it), is ill of uncinariasis; we know very well that that disease is produced by uncinaria, and that it is contracted by the contact of the skin with infected earth, producing a local dermatitis which the jibaro calls mazamorra. Where is the jibaro that has not suffered from mazamorra! Every one has been infected! He who has not had the infection through the feet because he is well shod, has received it through the hands in contact with infected earth, as I have been able to confirm practically in cases I have had among young ladies of good society who have been infected by tending their flowers in their gardens.

Not only does the rural population suffer from this disease, but it is also very general in the towns. For this reason we ought to work vigorously and not lose the hope of exterminating this plague in our island.—[Dr. B. Jimenez Serra.]

STATION OF AIBONITO.

Three thousand six hundred and forty-seven persons have been treated at the dispensary. Among the clinical cards that I found at this station from the work of the former commission, I was only able to find 15 reinfected, which shows what good results were obtained in the central station here in Aibonito for the year 1905, taking into consideration the large number treated. The Porto Rico Leaf Tobacco Co. has contributed much to the progress of this station, and I am continually receiving its workingmen, ill of anemia.—[Dr. E. Canino.]

STATION OF ARECIBO.

The most beautiful work, the most meritorious, the most trascendental and humanitarian that has been effected under the American flag has been, without the slightest doubt, the campaign against uncinariasis.

This disease was really decimating our population, and to-day we can say that Porto Rico has been saved from a doubtful future.—[Dr. Francisco M. Susoni.]

STATION OF BARRANQUITAS.

It is only proper to say that the incessant labor of the worthy members of the commission has made mighty little echo in some few municipalities of this island, which have accepted the installation in their towns of a dispensary more as pretext to lower the salary of the "Médico Titular" (municipal doctor) than to foster the interests of the unhappy jibaros.

Some of our municipalities are not doing a thing to change the habits of life of so many unfortunate beings that live in complete isolation, and lack at times even enough to eat. Without education, without instruction, without any kind of benefit from without, our jibaros, who are relegated to the most complete oblivion, will never be free of this plague of uncinariasis, which undermines their health and cuts them off in the flower of their youth.—[Dr. Felipe B. Vizcarrondo.]

STATION OF BARROS.

I wish to state that in the nine months that I am at the head of this station, and for the second time, that I am constantly seeing quite a number of cases of acute uncinariasis. Individuals that apparently have good color and health swell up in certain months of the year, and the edema is so bad as to cause shortness of breath. Almost all of them suffer from copious diarrhea.

In such cases in which I examined the feces microscopically I always found the eggs of uncinariasis.

I believe, and I should assert more loudly every day, that the anemia of the Porto Rican peasant is due more to uncinariasis than to poor and deficient food.

The following is a comparative study of the deaths from anemia in the three fiscal years previous to 1906 and 1907 compared with those of 1906 and 1907:

Years.	Deaths from anemia.	Per cent.
1903-4	123	82
1904-5	131	88
1905-6	52	34
1906-7	53	35

[Dr. Gregorio Santo Domingo.]

STATION OF BAYAMON.

In a country in which uncinariasis has assumed the proportion of a public calamity, we ought to work to see established in every town an anemia station, but also we should labor for the rigorous application of prophylactic measures.—[Dr. A. Stahl.]

STATION OF CAYEY.

First I wish to say that the support proffered and the confidence reposed in my station by the local authorities and plantation owners has been almost completely nothing. I observed in them the most complete indifference, but fortunately the public, and the majority of the public is the jibaro, has responded to the call to come and get cured, and has flocked to the station as often as distance, rain, and his work has not prevented him from coming. I should express my opinion that it would be very wise to stimulate the authorities of the towns and the plantation owners to cooperate in an intensive campaign against uncinariasis. Cayey is invaded in a most extraordinary manner by this terrible endemic. The soil is mountainous, the industry is coffee, and the climate is rainy and chilly.

In these conditions infection is sure, and several thousands of inhabitants are suffering from it. The beneficent results the stations of anemia dispense to our laboring classes bring out very clearly that the first and most important labor is the sure and rapid cure of an infirmity that has accompanied some of them from their most tender years, impoverishing their physique, depriving them of the necessary strength to work, and converting them finally into cachectics, whom the lack of hospitals obliges to remain in isolated huts, where they are found by the hundreds, waiting for a tardy death.—[Dr. Francisco Izquierdo.]

STATION OF COAMO.

No one fails to see the importance of this campaign taken up directly in the interests of our working classes, and it is impossible to deny them the assistance of science, considering their avidity for cure. To secure this treatment we see them come to the station from the most distant points of the island. We have here 125 anemics, who come weekly and on foot from a barrio near Juana Diaz, a distance of 6 leagues.—[Dr. Leonardo Igaravidez.]

STATION OF COMERIO.

In this municipality tobacco culture is increasing progressively every year. This year's crop will be three times that of previous ones. Tobacco is the chief source of wealth upon which this town must count and that which has chiefly contributed to this new industry is the station for the treatment of anemia, in which a large number of country people have been cured or notably relieved and who return to their labor to make efficient the efforts of their hard-working employers.

So convinced are the workingmen of the necessity for coming to the station that they arrive from the most distant points in the mountain districts, covering considerable distance over inaccessible roads to secure their health.—[Dr. Martin O. de la Rosa.]

STATION OF COROZAL.

I wish to declare without the slightest ambiguity that I was one of those that accepted as the almost exclusive cause of our anemia deficient food and the lack of comfort in the life of the rural population. I did not know what the "natural cure" of uncinariasis was, which to-day, familiarized with the use of the microscope, I can explain perfectly.

I have followed week by week, in some intensely ill patients, the results of treatment. I have seen the improvement of the patient on the complete disappearance of the ova from the feces. Then it was that I saw the magic transformation of a helpless creature who daily dreamed of death which would put an end to his misery into a man of full vigor.

This man, who took no other drug than thymol or betanaphthol and who continued to eat his rice and tubercles, nevertheless enjoyed vigorous health as soon as he was free of the parasites. Does that not give me the key to the origin of our anemia? To-day the jibaro, yesterday's skeptic, comes to the station full of faith, and the number is increasing every day, not of persons who simply want to try a new thing, but of sick who come convinced that from that station they will go out cured.—[Dr. A. Bou la Torre.]

STATION OF HUMACAO.

The governmental measures for the purpose of exterminating anemia in this island are known by everybody and they save from death thousands of victims who annually perished from anemia.—[Dr. Isidro A. Vidal.]

STATION OF ISABELA.

This physician mentions that at first he had a large number of sick who realized the good results of the treatment and cheerfully submitted to it, but that during October, on account of heavy rains and the coffee harvest, at which times an emigration of people from the coast to the highlands took place, his clinic fell off considerably. This same clinic became very large again after the harvest.

The number of patients was 2,595, and this is small compared with that of other stations, but it is a large number to me, if I have been able—as I believe I have—to drag 2,595 jibaros out of the error of believing that anemia is due to poor food and to convince them that it is due to an intestinal parasite.

A few days ago a jibaro presented himself at the station carrying his feces to be examined, but the examination was negative, and I said to him: "You have no anemia," to which he replied: "That is a mistake, Doctor; I caught mazamorra the other day, and I must have it." I had to sit down then and there and explain to the patient that he would have to return later, when his mazamorras should have reached his stomach.

He did so, and then I found the eggs. The country people around here speak very frequently of the necessity for using shoes, of the "microbe" of uncinariasis, of mazamorra in the stomach, etc., all of which demonstrates that they have taken serious account of the true cause of their illness and that they have recognized the benefit that they have received from taking a dose of the usual drugs.

The intense and very intense forms of uncinariasis are not so frequent on the coast as they are in the interior.

The mortality from uncinariasis has been reduced from 128 deaths in 1905–6 to 62 in 1906–7.

It is my hope that this honorable commission may always have the decided support of our legislators and may continue their work of saving human beings from threatened death and of turning them over, healthy and robust, to their families and their country.—[Dr. Luis Gonzalez Garmendia.]

STATION OF JUNCOS.

This station, when it was opened for the treatment of uncinariasis, the 1st of September, 1906, needed no advertisement to bring the sick to the dispensary.

We tried at first to treat 6 or 8 patients from each barrio, and the rapid and sure result obtained was the best advertisement we could have had, as we very soon observed in the torrent of patients that hastened to secure a remedy that would in so brief a time put an end to their long and painful disease.

Among the cured, although we can not give a scientific account because we had no hospital, there were true resurrections, because from cadavers they were converted in a few days into men valuable for work and capable of sustaining their families, some of them abandoning their enforced vocation of beggars. The faith with which our country people cover great distances over bad roads and paths and often without respecting the inclemency of the weather, is the best practical demonstration of the results of the cure of anemia by the remedies indicated by the commission. The work of the commission, supported by the stations of anemia, is an extremely worthy labor, and undoubtedly and without exaggeration the most important for the health of the people of Porto Rico since the American invasion of the island.—[Dr. Pedro J. Palou.]

STATION OF LARES.

There is absolutely no doubt, gentlemen of the commission, that the work begun by yourselves will, when finished, occupy a splendid page in the history of Porto Rico.

In the year 1902 there were 666 deaths; in 1903, 515; in 1904, 589; in 1905, 549; in 1906, 426; and in 1907, 222.

I have inscribed 5,128 patients.—[Dr. J. Benet Valdès.]

STATION OF MANATI.

It was necessary to advertise the work at first to attract the greatest number of sick possible, and from my own pocket I had printed 2,000 copies of a pamphlet divided in three parts. In the first part I urged all who could read

to make known to the country people that their disease was curable and that the Government had installed an officer to attend them and cure them. In the second part I explained in plain language the cause of their infirmity, the manner in which they had acquired it, and the way in which it could be cured. In the third I detailed a number of ways of avoiding it. This pamphlet was illustrated with pictures of the parasites.

This gave a surprising result in the great number of sick which came to the station, and the progress of the work was greatly assisted by those who had become cured and bettered in a short time, and who were the wonder of the vicinity in which they lived.—[Dr. Felipe B. Cordero, ex-director of health of the island.]

This physician of his own free will requested permission to take up the work in Ciales in order to extend the radius of influence of his station.

STATION OF MAYAGÜEZ.

This physician was one of our assistants in the work of the commission in Aibonito in 1905. He states that he believes that eucalyptol was very inferior to thymol or betanaphthol and more dangerous, and that the symptoms caused by this drug resulted in the sick refusing to submit again to that drug. He adds:

I never had any knowledge of any case in which thymol and betanaphthol produced alarming or even disagreeable symptoms.—[Dr. Manuel Dueño.]

STATION OF MOROVIS.

During the time that I have been at the head of this station I have observed how great has been the benefit received by those individuals that have solicited treatment and have occasion to note how they have recuperated their health. A great number of people who were yesterday helpless in any kind of manual labor to-day dedicate themselves to heavy agricultural work, thanks to the treatment in this office of 3,224 persons.

In 1903 104 persons died of anemia; in 1906 only 36 persons died. I believe that in order to accustom our country people to observe hygienic rules it will be necessary to give a series of talks in the country on the cause and prevention of the disease and to establish in the densely populated barrios a medical service that could be rendered one day in each week or once in two weeks, as the distance between some barrios and the towns is the cause of many not coming to the stations.—[Dr. Pedro Rivera.]

STATION OF SAN GERMAN.

Of 9,414 persons sick of uncinariasis, treated at the station, only 6,103 belong to this municipality and the rest walked from neighboring municipalities.

This doctor states that two towns have furnished a large number of patients because of good roads connecting them with San German and because there are few rivers to cross, while other places nearer, owing to the difficult roads patients had to take, especially the women and children, gave comparatively few.

For this reason it is my opinion that the station ought to be movable. That is to say, I believe it would be well if the station here should be open two days in the town for its sick and for those of near-by barrios; two days in the highlands in, say, barrio Rosario; and two days in some of the still more distant barrios from which many people do not come.

In this way I am sure that in a short time uncinariasis in the municipality would be exterminated.

The 9,414 patients made 44,661 visits and only 18 died. I have used, in 11½ months, 140 pounds of thymol, 100 pounds of betanaphthol, and 2,082,160 grams of sulphate of soda, or a little over 2¼ tons.

One illustration will show how beneficent this work is: In San German, with a population of 20,000, 149 persons died of anemia in the fiscal year 1905, and in the fiscal year 1907 only 77 persons have died of this disease.—[Dr. P. Malaret.]

STATION OF SAN SEBASTIAN.

The problem of anemia in this island is, without the slightest doubt, the most important problem that has been treated by the legislative bodies of Porto Rico. Other questions of interest and of great urgency may have reached them, meriting their most careful attention, but none so important as that of anemia, from which the Porto Rican people suffer—a problem of life, social and economic.

The honorable governor of Porto Rico, a man who influenced in a decided manner the beginnings of this campaign when he was secretary of Porto Rico, and whom the people consider a public benefactor in this matter, merits the applause and warm congratulations of the agricultural class of this island that has reached a new era in determining its future.—[Dr. J. Franco.]

STATION OF VIEQUES.

This physician states that he found 13.71 per cent of his patients infected by *schistosoma mansoni.*

We have never seen a case where the patient did not have mazamorra. The most important and serious problem of all that are connected with uncinariasis in Porto Rico is that of preventing it.

The proprietor of an agricultural farm is very little worried about the health of his laborers. The orders that have been promulgated concerning privies in general have not been obeyed, and I have known some proprietors that have tried to persuade their sick not to come to the station, because they were going to lose a day of work. Our legislators should strain every nerve before they permit this magnificent work to fall, in order that their efforts in the past may not be lost.—[Dr. Guillermo Carrera.]

STATION OF YAUCO.

I have to commence this report by acknowledging that my efforts have been fruitless in securing as large a number of patients at the station as I wanted to have. It is true that Drs. Gaudier and Belaval, with me, have reported on 2,000 cases; but what is this number compared with the true number of anemics in a municipality which contains 27,000 people!—[Dr. Rafael P. Gatell.]

THE FOURTH REPORT OF THE PORTO RICO COMMISSION.

COMMENTS UPON THE REPORT FOR 1907–8.

The body of the report has been reproduced entire. We are regretful of having to omit a very important appendix, the official estimate of the value of the work against uncinariasis from the municipal government of each town. In this appendix (Spanish edition) are found letters from the alcaldes and resolutions of town councils of 37 towns in which, without a dissenting voice, this work is pronounced of prime importance for the future development of the island. The two which best express that which nearly all contain are translated into English and printed in full. A résumé of these letters from alcaldes and resolutions unanimously passed in municipal councils is as follows:

1. All towns attest to the excellent results of the stations. Some few limit their estimate of these results to a short statement; others to a general and enthusiastic tribute to the work, without specifying particular benefits; the vast majority, however, point out clearly the manner in which the municipalities have been aided by the dispensary.

2. Thirty-two eloquently describe the improvement in the health of the people of the country districts especially, and of those of the towns in less degree.

3. Twenty-five state that the work occasioned a fall in the mortality of the municipality, usually over 50 per cent reduction in deaths from "anemia."

4. Twenty-three declared that the dispensary of the commission had saved the municipality some or a great deal of money which heretofore had been appropriated to buy medicines for the poor. Six stated that the station had either not benefited the town from the standpoint of municipal appropriation for medicines or that this appropriation had had to be increased. All, however, averred that they were only too glad to bear any increase in expense in consideration of the enormous benefit afforded the laboring classes.

5. Nine especially lauded the self-sacrifice and conscientiousness of the directors of the stations.

6. Twenty-three expressed their profound regret at the closing of the station by reason of the failure of the budget to pass the legislative houses in San Juan. This was the year in which there was a temporary suspension of the work for a few months, due to legislative difficulties not at all connected with the work. On the contrary, the two houses were willing and anxious to pass a bill sustaining the work, as will be seen in the fact that such a bill was passed in extra session called by the governor to consider two problems, that of irrigation and the other of anemia.

7. Nine urged the governor to call a special session of the legislature to appropriate money for a continuance of the work.

It is impossible to describe in such a summary the interest and sincerity of these appeals of the whole people to push forward in a campaign which they had learned in the only way one ever learns anything of this sort to appreciate as a work saving of health, of money, and of life.

PORTO RICO ANEMIA COMMISSION.

Dr. P. Gutiérrez Igaravídez, chairman. Dr. I. González Martínez; Dr. F. Seín Seín. Honorary members: Dr. B. K. Ashford, United States Army; Dr. W. W. King, United States Public Health and Marine-Hospital Service.

OFFICE OF THE CHAIRMAN,
San Juan, P. R., July 31, 1908.

Hon. RÉGIS H. POST.
Governor of Porto Rico, San Juan, P. R.

SIR: We have the honor to transmit herewith a report of the work performed by the Porto Rico Anemia Commission during the fiscal year 1907–8, and copies of the letters addressed to the commission by the city councils of the island concerning this work.

Very respectfully,

P. GUTIÉRREZ IGARAVÍDEZ, M. D.
I. GONZÁLEZ MARTÍNEZ, M. D.
FRANCISCO SEÍN SEÍN, M. D.

REPORT OF THE PERMANENT COMMISSION FOR THE SUPPRESSION OF UNCINARIASIS IN PORTO RICO.

The 35 stations devoted to the treatment of uncinariasis at the end of the fiscal year 1906–7 were kept open during the following year. but some of them were transferred to other towns.

Those existing at Utuado, Guayama, Bayamon, Caguas, Arroyo, and Morovis were transferred to Patillas, Peñuelas, Rio Grande, Ciales, Juana Diaz, and Guayanilla, and furthermore the directors of the stations at Quebradillas, Las Marias, Añasco, Manati, Aguadilla, and Mayagüez went periodically to Camuy, Maricao, Rincon, Barceloneta, Moca, and Hormigueros, respectively, to treat patients soliciting relief from their anemia. Consequently, we can assert that 42 towns have been helped during the past fiscal year, and the whole island has received the benefits of this work.

To make the work of administration easier, the commission maintained the plan of the division of the island into three districts, as before, but in order to secure a prompter delivery of supplies to the stations the office of the chairman, with the general supply depot, was moved from Rio Piedras to San Juan, and two subdepots were installed at Mayagüez and Ponce.

No essential change in the working plan was considered necessary by the commission this year.

The stations have followed the same policies as those already set forth in our annual report for 1906–7, and the sick population of our rural districts has become more and more deeply interested in the prophylaxis of "anemia" as taught at our stations, and more eager to receive the specific treatment which promises so striking a cure.

The proof of this earnest desire for relief is found in the number of patients applying for treatment at the recently opened stations,

and the steady influx of new patients at points where stations have been existent for two years.

Being fully aware of the difficulties to be met in the preparation of statistics, the commission tried to simplify this work by means of a printed form reading as follows:

PORTO RICO ANEMIA COMMISSION.

Station of..... Year 1907–8.

Date.	Serial No.	Sex.		Color.		Age.							Clinical type.					Residence (Barrio).			Result.					Remarks.
		Males.	Females.	White.	Colored.	Less than 10	10 to 20	21 to 30	31 to 40	41 to 50	51 to 60	Over 60	Very light.	Light.	Medium.	Intense.	Very intense.			From other towns.	Cured.	Practically cured.	Under treatment.	Ceased to return.	Died.	
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....
.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....
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.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....

The required data were daily transferred from the clinical cards to this printed form. Each sheet had space enough for 100 cases. Consequently, the directors of stations were able to classify their cases, without separately examining the clinical cards, and the commission could prepare the general statistics more rapidly, taking for a basis the summaries forwarded by the stations as they appear in Table No. 2.

The total number of patients treated was 81,375; 41,120 were male and 39,734 female. According to these figures, the percentage of the former was 50.53 per cent and that of the latter 48.83 per cent, 521 patients, or 0.64 per cent, remaining unclassified.

The largest number of patients were males, and this is due to causes explained in our last report.

The color of the patients was taken into consideration this year, and the following figures were obtained:

	Per cent.
65,455 white patients	80.42
15,399 colored patients	18.92
521 unclassified	.66

The classification as to age was somewhat modified, and the following groups were formed:

Age.	Patients.	Per cent.
Under 10 years	8,954	11.00
From 10 to 20 years	30,625	37.63
From 21 to 30 years	21,983	27.02
From 31 to 40 years	10,736	13.19
From 41 to 50 years	5,212	6.40
From 51 to 60 years	2,321	2.86
Over 60 years	883	1.09
Unclassified	661	.81

The groups formed by the patients whose ages are between 10 and 20 and 21 to 30 give a total number of 52,608, or 64.65 per cent of the whole number treated.

The young, as we said in our last report, furnish the greatest number of patients.

Thus it is the laboring classes, those who must give vitality to the industrial progress of the island, who, gravely menaced by this parasitic disease, invade our dispensaries and demand that which their experience shows them will result in the upbuilding of a failing strength and a cure for their semi-invalidism. Anyone who has had an opportunity to observe the daily labor of a station will be convinced of the fact that hundreds of men desirous of strength to earn their living are thus returned to their labor, and that those men, although in the flower of their youth, were previously unable to yield the full value of a day's work.

In our last statistics the percentage of young patients was 58.25 per cent, the difference being very little between this figure and that obtained this year.

The patients under 10 years show a percentage (11 per cent) almost equal to that offered for the same class of patients in the past fiscal year (9.99 per cent).

The patients whose age is between 31 to 60 and those over 60, taken as a whole, give a percentage of 31.64 per cent in 1906–7 and 23.54 per cent during 1907–8.

The total number of patients treated this year, classified according to the intensity of the disease they presented, gives the following percentage for each class:

	Per cent.
Very light	3.71
Light	18.39
Medium	49.32
Intense	23.53
Very intense	4.26
Unclassified	.79

The relation between these percentages and the result of the treatment has not been estimated, but the figures are almost the same as those obtained last year.

As to the results of treatment, 25,757 were entirely freed of uncinariæ and reached a normal percentage of hemoglobin; 16,192 have been considered as practically cured or freed of all evidence of disease and almost entirely liberated of their uncinariæ. That means 31.65 per cent for the former and 19.89 per cent for the latter, a total of 51.54 per cent cured.

The number of those who abandoned treatment, after having received more than 2 doses of the anthelminitics employed, and who were therefore improved, as explained in a previous report, amounts to 12,203, or 15 per cent of the total enrollment.

Ninety-three, or 0.12 per cent of the total number of 81,375, died from uncinariasis. There were no other deaths among our patients save these.

Of course, the mortality that our statistics show does not represent the total mortality from uncinariasis in the entire island, because this data is only from towns where stations have been working, and the number of these is but 35. Nor can this mortality be considered

absolutely exact for the very towns where there has been a station, for some deaths occurred in patients that were not treated at the station and who were not enrolled there.

But even with these exceptions the mortality from this disease has fallen considerably in the statistics furnished for the entire island.

We are indebted to the honorable superintendent of health for the following table of deaths from anemia occurring in the island from 1900 to 1908, and these figures demonstrate in the clearest manner how we have succeeded in combating the mortality from this disease.

Statement of deaths from anemia from 1900 to 1908.

1900–1901	11,875
1901–2	6,284
1902–3	6,830
1903–4	6,179
1904–5	4,963
1905–6	3,769
1906–7	1,134
1907–8	1,785

At the close of the fiscal year 1907–8, 26,569 patients were receiving treatment at the stations, this figure being 32.65 per cent of the total number of the patients enrolled during the whole year.

	Number.	Per cent.
Cured	25,757	.....
Practically cured	16,192	51.54
Improved	12,203	15.06
Under treatment	26,569	32.65
Died	93	.12
Unclassified	561	.69
	81,375	100

The list of towns where the stations have been open, and the number of weeks each station has been working, are registered in Table No. 1, where the records of visits made by each patient may also be found.

This summary shows that the attendance has been equal to that of last year, and had we recorded the final visit made by each patient before being certified as cured, this figure would be over 500,000.

In preparing these statistics we have not included the patients who were under treatment on June 30, 1907, and either cured or died during the following year. Table No. 3 is the record of these patients (those under treatment on June 30, 1907), the stations attended by them, and the results of treatment.

As no provision was made in the budget for the fiscal year 1908–9 for the continuance of our campaign against uncinariasis in Porto Rico, the commission, with the consent of the honorable governor, ordered that all stations be closed on June 30, 1908. It was also ordered that such medicines as remained on hand in each station be delivered to the alcaldes, to be used by them for the continuance of the treatment of the poor patients of the municipalities, and that the medicines stored in San Juan, Mayagüez, and Ponce be distributed among the municipalities for the purpose above referred to.

It was also ordered that the laboratory supplies and other property of the insular government used in the offices of the commission be delivered to the municipal authorities, to be held by them on memorandum receipt.

The lack of appropriation to carry on the work being known, the commission considered it pertinent to ask the opinion of each municipality where a station had been open concerning the work performed by such station. The answers received from the municipalities are printed in the last part of this report. Only two are translated into the English language, as they are fair examples of the rest, and are as follows:

RESOLUTION PASSED BY THE MUNICIPAL COUNCIL OF COAMO PETITIONING THE LEGISLATIVE ASSEMBLY OF PORTO RICO TO CONTINUE THE WORK OF THE PORTO RICO ANEMIA COMMISSION.

The mayor, D. Manuel Betances, addressed a message to this council, as follows:

"It is to be regretted that the legislative assembly of Porto Rico failed to appropriate funds for the treatment of the thousands of sufferers from anemia when the efficacy of such treatment in saving human beings from certain death is a matter of common knowledge.

"Of course after the stations which to-day exist have disappeared the municipalities will have greater expenses to meet, for they will be obliged to attempt as well as they are able to complete the cure of those who are now undergoing treatment and to take up new cases which will present themselves. In my opinion, however, this will not give so favorable a result as that now being attained, for at present there is an adequate personnel and a supply of medicine ample for all, not to mention the scrupulous care with which records of cases are being kept. This could not be followed out in the future by the municipality on account of the sums which it would have to subscribe to maintain the personnel.

"This honorable council will, I have no doubt, regret, as do I, the cessation of the work of the anemia commission and its stations, and should frame a resolution in which the necessity for its continuance shall be made clear. This resolution should be addressed to the honorable governor, who has authority to convoke a special session of the legislative assembly, and can interest that body in appropriating an amount at least equal to that appropriated for this object for this fiscal year, 1907–1908.

"A copy of this resolution should also be sent to the honorable speaker of the house of delegates, the honorable president of the executive council, and to the honorable president of the anemia commission.

"It is unnecessary to call attention to the value to this country of the work this most worthy commission is at present doing, and would do in the future, in converting an untold number of helpless sick men into strong and active laborers, thus economizing moneys which can be applied to new necessities of the towns."

Therefore, in view of the universally acknowledged benefits derived from the work of the anemia commission of Porto Rico by our laboring classes; be it

Resolved by this council, (1) That this council unanimously agrees to all that is recommended by the mayor, D. Manuel Betances, in the above message;

(2) That it respectfully prays the honorable governor and the Legislative Assembly of Porto Rico to take action upon this most important matter as affecting the health of a people;

(3) That certified copy of this document be transmitted to the honorable governor, the president of the house of delegates, the executive council, and the anemia commission.

The secretary subscribing this document certifies that it is a copy of the resolution passed by the municipal council of Coamo in its session of the 10th of April, 1908, approved by the mayor the 14th day of the same month and year. And to this I do subscribe these presents in Coamo, the 15th day of April, 1908.

HERIBERTO B. FONTANES,
Secretary of the Municipal Council of Coamo.

A true copy:

CLOTILDE APONTE,
Acting Mayor of Coamo.

THE RESOLUTION ADOPTED AND APPROVED BY THE MUNICIPAL COUNCIL OF JUNCOS IN ITS REGULAR SESSION OF THE 23D OF APRIL, 1908.

A letter was read from Dr. P. Gutiérrez Igaravídez, president of the anemia commission, addressed to the alcalde and referred by him to the council, in which he states that no appropriation was made in the last session of our legislature to continue the work against anemia in Porto Rico, and that on this account the commission was obliged to terminate its labors, closing the stations on the 30th of June. He also desires to know if, apart from statistical data sent the commission, this municipality has derived any benefits in the matter of public charity from the anemia station which has been working here; if, in a general way, the health of the municipality, that of its working classes, has bettered since the station was open to the public, and if, in comparison with previous years, the mortality of the adult population has diminished.

The council is surprised that the legislature has not appropriated any funds for the continuance of this work in the coming fiscal year, and believing the suspension of the work of these stations to be a true misfortune to our rural population, decides, at the suggestion of the president of the council, Señor Delgado, to inform the president of the anemia commission that the work of this station has been productive of great economic benefit because, had it not existed, we would have had to considerably increase our budget for public charity in order to attend to the treatment of thousands of persons among our rural population suffering from the anemia produced by the parasite "uncinaria," who to-day enjoy good health. For this reason the health of the municipality has been decidedly improved since the opening of this station, and it would have lowered the mortality considerably among our adult population had this not been unusually increased in the last two years. The council decides to take action in order that the service of the commission for the suppression of anemia in Porto Rico may not cease and adopts the following resolution:

"RESOLUTION RESPECTFULLY PRAYING THE HONORABLE GOVERNOR OF PORTO RICO, IF HE THINKS IT FOR THE GENERAL GOOD, TO CONVOKE THE LEGISLATURE IN SPECIAL SESSION FOR THE PURPOSE OF PASSING A LAW PROVIDING FOR THE CONTINUANCE OF THE WORK OF THE COMMISSION FOR THE SUPPRESSION OF ANEMIA IN PORTO RICO BY APPROPRIATING THE NECESSARY FUNDS.

"Whereas a great part of the rural population of the island suffers from anemia, a disease caused in the majority of cases by the parasite 'uncinaria';

"Whereas the cause of this variety of anemia has produced innumerable victims among the rural population, until in a happy hour the remedy was applied which destroyed the disease-producing organism and converted individuals who were dragging out a life of suffering and misfortune into strong and healthy men and women;

"Whereas in order to consummate this magnificent result anemia stations were established, provided with intelligent personnel, apparatus, and medicines;

"Whereas the Legislature of Porto Rico in its last session failed to sustain these stations for the coming fiscal year, 1908–9;

"Whereas these stations have saved thousands of persons from death, giving them health, and with this energy, strength, and contentment, these individuals having been previously weak and ill developed, for whom life was a burden;

"Whereas there are still many thousands more in the island attacked by this cruel infirmity;

"Whereas it is humane to continue the beautiful work of charity begun until this great affliction disappears from among us, a scourge that so pitilessly invades our rural population;

"Whereas the chief duty of a wise and honorable administration is to watch over the health of the people, because a sickly people lacks energy and initiative, and thus can be neither free nor prosperous;

"Whereas the municipalities of the island are absolutely unable to meet the expenditures which this anemia occasions, because the amount devoted to public charity is too small and is intended for the treatment of other ordinary diseases;

"Whereas one of the real and positive benefits that the change of sovereignty has brought the island is the founding of the stations for the suppression of anemia in Porto Rico, and this benefit we should try to preserve forever: Therefore, be it

"*Resolved by the muncipal council of Juncos,* (1) That this council address to the honorable governor of Porto Rico their respectful request that he convoke the legislature in special session to pass a law providing that during the fiscal year 1908–9 the commission for the suppression of anemia in Porto Rico be continued, appropriating for this end the necessary funds;

"(2) That the assistance of the municipal councils throughout the island be solicited, that they may address similar requests to the honorable governor of Porto Rico, founding their request upon bases similar to these herein expounded;

"(3) That as soon as this resolution be approved by the honorable alcalde, he comply with the provisions of section 1, providing the honorable governor with certified copies of the same;

"(4) That in order to comply with the provisions of section 2 certified copies be provided the other municipal councils of the island;

"(5) That this resolution take effect from the day of its approval."

NARCISO VARONA SUAREZ,
Secretary of the Municipal Council of the Town of Juncos.

I certify that the preceding resolution was adopted by the municipal council in its session of the 23d of April of this month, and approved by the alcalde the 25th of the same month. And in order to comply with its provisions, I make the aforesaid copy for Dr. P. Gutierrez Igaravidez, president of the anemia commission, this 27th day of April, 1908.

NARCISO VARONA, *Secretary.*

A true copy.

BARRERAS.

Of the $60,000 appropriated for the work of the commission in this year's work, $56,950.57 has been expended:

Personnel	$43,666.81
Medicines	8,391.95
Miscellaneous expenses	1,225.72
Transportation	480.68
Laboratory and its equipment	831.73
Printing	1,366.36
Mail and telegraph	407.07
Expenses incident to inspection in towns and other official trips	580.25
	56,950.57
Appropriation	60,000.00
Balance on hand in treasury of island	3,049.43

THE FIFTH REPORT; RENDERED BY THE DIRECTOR OF THE "ANEMIA DISPENSARY SERVICE," SUCCESSOR OF THE PORTO RICO ANEMIA COMMISSION.

COMMENTS UPON THE WORK OF 1908–9.

In this year the commission was disbanded, and an anemia dispensary service took its place. Its report is short and is reproduced in full.

A separate report was not made, as the service was made one of the subbureaus of the bureau of health, in the department of health, charities, and corrections. Its director was Dr. Pedro Gutierrez Igaravidez.

Report of the Director of the Anemia Dispensary Service of Porto Rico, 1909.

AN ACT To provide for the continuation of the work of the suppression of tropical anemia, or uncinariasis, in Porto Rico.

Be it enacted by the Legislative Assembly of Porto Rico:

Section 1. For continuing the work of suppressing the disease known as tropical anemia, or uncinariasis, there is hereby created a special medical organization to be designated as the anemia dispensary service, which shall be composed of a director, who shall be a qualified physician, and such number of physicians, residents of the several municipalities wherever possible, as will be necessary to provide the necessary medical personnel for dispensaries for the prevention and treatment of uncinariasis. The director shall be appointed by the director of health, charities, and corrections for a term of two years, and until otherwise provided by law shall receive a salary of two thousand and five hundred dollars per annum. The physicians shall be selected by the director of the anemia service and shall receive an annual salary not exceeding four hundred and eighty dollars each. The municipalities may also appoint one assistant for the physician, at such salary as may be fixed by the respective municipal councils.

Sec. 2. It shall be the duty of the director to use all means in his power to prevent, combat, and exterminate the disease known as uncinariasis in Porto Rico, and for the purpose he is directed and authorized to establish and maintain a central office for the administration of the work, with the following assistants: One chief clerk, at nine hundred dollars per annum; one shipping clerk, at seven hundred and twenty dollars per annum; one typewriter, at three hundred and sixty dollars per annum; and one messenger. at two hundred and forty dollars per annum, all to be appointed by him according to the civil-service laws and regulations of Porto Rico. It shall be the duty of the director to establish a station for the carrying on of the work in all municipalities desiring to take advantage of the provisions of this act, said stations to be in charge of the physician appointed, in accordance with this act, with supplies and medicines provided by the insular government.

Any of the municipalities of Porto Rico as are willing to cooperate in the work according to the provisions of this act, by furnishing a suitable building, shall be accorded a dispensary and the services of a physician.

SEC. 3. It shall be the duty of the physician designated for a town wherein a dispensary may be established under the provisions of this act to personally superintend the treatment of all cases presenting themselves, and he shall be responsible to the director for the care of the sick thereat and for the efficient administration of the dispensary. The assistant who, as far as possible, shall be a practicante, shall render all such services as may be required of him by the physician in charge of the dispensary, in accordance with such regulations as may be issued by the director for the rendition thereof.

SEC. 4. It is hereby expressly provided that the provisions of section 177 of the political code are hereby suspended in so far as to permit "médicos titulares" already paid by the towns to receive a further compensation from the insular government for the work above stated.

SEC. 5. In each municipality wherein a dispensary may be established there shall be created an advisory board, composed of the alcalde, the health officer, or a pharmacist, and president of the school board of such municipality, whose duty it shall be to inspect and report to the director upon the work of the dispensary at least once each month, with recommendations which in their opinion could be adopted for the more perfect working of the said dispensary.

SEC. 6. The work of the organization herein created shall be under the direct supervision of the director of health, charities, and corrections, whose approval of all regulations of the service, of appointments of physicians in charge of dispensaries, and the expenditure of money placed under the direction of the director of the anemia service shall be required.

No money shall be expended for the construction, rent, or repair of buildings to be occupied as dispensaries, but in case of necessity the director of the anemia service may select and lease such quarters for the central office as may be deemed necessary.

SEC. 7. The director of the anemia service, in order to carry out his work, shall receive the cooperation and assistance of the officers of the bureau of health of the insular government.

SEC. 8. All property that has been acquired heretofore by the Porto Rico anemia commission and belonging to the people of Porto Rico, including the records of said commission, shall be turned over to the director of the organization hereby created and shall by him be utilized where it may best serve the interests of the service for the diagnosis and treatment of patients or for the investigation of problems of scientific importance so as to acquire a better knowledge of uncinariasis.

SEC. 9. To carry out the purposes of this act there is hereby appropriated out of the moneys in the treasury not otherwise heretofore appropriated, for the remainder of the fiscal year ending June thirtieth, nineteen hundred and nine, the sum of thirty-seven thousand five hundred dollars, or so much thereof as shall be necessary.

SEC. 10. That "An act to create a permanent commission for the suppression of uncinariasis in Porto Rico," approved March eighth, nineteen hundred and six, and an act amendatory to the same, approved March fourteenth, nineteen hundred and seven, and all other laws or parts of laws in conflict with this act are hereby repealed.

SEC. 11. That this act shall take effect from and after the first day of October, nineteen hundred and eight.

Approved September eighteenth, nineteen hundred and eight.

SAN JUAN, P. R., *June 30, 1909.*

SIR: I have the honor to submit herewith the annual report of the anemia dispensary service for the fiscal year 1909.

In accordance with the provisions of "An act to provide for the continuation of the work of the suppression of tropical anemia in Porto Rico," the director of the anemia dispensary service addressed on October 8, 1908, a circular letter to the alcaldes of the several cities and towns of the island informing them of the new organization of the bureau and that work would be started at once, according to the provisions of such act. The sections of the act that made reference to the municipalities were copied in the circular letter.

All the cities and towns having enjoyed the benefit of a station during the past fiscal year asked for the granting of a dispensary, and the remaining towns sent also their petitions, every municipality making the offer of proper quarters for the dispensaries.

Therefore the 35 stations closed on June 30, 1908, when the permanent commission for the suppression of anemia was discontinued, were reopened on November 1, 1908, and the number was gradually increased to 59, located in the following towns:

Adjuntas, Aguadilla, Aguas Buenas, Aibonito, Añasco, Arecibo, Arroyo, Barranquitas, Barros, Bayamon, Cabo Rojo, Caguas, Camuy y Quebradillas, Carolina, Cayey, Ciales, Cidra, Coamo, Comerio, Corozal, Fajardo, Guayama, Gurabo, Hatillo, Humacao, Isabela, Juana Diaz, Jayuga, Juncos, Lajas, Lares, Las Marias, Loiza, Manati, Maricao, Maunabo, Mayaguez, Moca, Morovis, Naguabo, Patillas, Peñuelas, Ponce, Rincon, Rio Grande, Rio Piedras, Sabana Grande, Salinas, San German, San Juan, San Lorenzo, San Sebastian, Toa Baja, Trujillo Alto, Vega Baja, Yabucoa, Yauco, Vieques, and Vega Alta.

The inscription and treatment of patients in the several dispensaries was the same as that adopted by the anemia commission in their dispensaries, with the difference that the forms were supplied with colored cards for patients coming for the first time to the dispensaries, the white cards being reserved for those who were previously registered, and after being examined by the physician, had received medicines. The inscription of old patients as new ones was thus prevented.

The total number of patients of the first class, viz, those coming for the first time to the dispensaries during this fiscal year, was 54,725, and of those who applied for treatment in past years and came to continue same were 9,159, making a total of 63,884 persons attended in the 59 dispensaries of the service.

The model of statistics adopted in the dispensaries was the same as that used by the anemia commission in the preparation of its last report, and the classification of cases has been made easier.

The patients treated during past years and classified in the last report of the anemia commission have now been classified in regard to their cure, as shown in the appended exhibit.

The total number of patients was 54,725, of whom 27,026 were male and 27,699 female. According to these figures the percentage of the former was 49.39 per cent and of the latter 50.61 per cent. This is the first time that a difference in favor of females is shown in the statistics of this work.

In the classification of patients as to color, the following figures were obtained:

	Number.	Per cent.
White patients	44,433	81.19
Colored patients	10,292	18.81

The classification of the 54,725 patients as to age gives the following figures:

	Number.	Per cent.
Under 10 years	6,668	12.19
From 10 to 20 years	20,299	37.09
From 21 to 30 years	14,606	26.69
From 31 to 40 years	7,518	13.74
From 41 to 50 years	3,584	6.55
From 51 to 60 years	1,520	2.77
Over 60 years	530	.97

The groups formed by the patients whose ages are between 10 and 20 and between 21 and 30 give a total number of 34,905, or 63.78 per cent, of the whole number treated. In the last statistical report the percentage of this group was 64.65 per cent, or 0.87 per cent only, over that obtained for this year. This high percentage gives always about the same figures, because men and women whose age is between 10 and 30 are those more in contact with the sources of infection.

By a comparison of the percentage given by patients under 10 years, 31 to 40, 41 to 50, 51 to 60, and over 60, with that of same groups in the last statistics, we can observe what very little difference there is between the corresponding figures.

As to the clinical form or intensity of the disease, the patients are grouped in the following manner:

	Patients.	Per cent.
Light	10,720	19.589
Medium	24,248	44.310
Intense	16,409	29.983
Very intense	3,344	6.111
Unclassified	4	.007

As to the results of treatment, 15,972 were cured and 6,734 practically cured. That means 29.19 per cent for the former and 12.30 per cent for the latter, a total of 22,706, or 41,498 per cent of the total enrollment.

The classification of the 54,725 cases, according to the results of treatment, are:

	Cases.	Per cent.
Cured and practically cured	22,706	41.498
Improved	7,344	13.419
Under treatment	24,626	44.998
Died	46	.084
Unclassified	3	.001

The appended exhibit shows that of the 9,159 patients receiving treatment or who were attended at the dispensaries during the past year, 2,577 were cured, 1,353 were practically cured, 1,039 improved, 4,182 remained under treatment, and 8 died.

The expenses of the service consisted in the payment of salaries, the purchase of medicines and microscopes for towns that had none, the total being $32,360.91. The per capita expense shows an average of 51 cents.

P. GUTIERREZ IGARAVIDEZ,
Director Anemia Dispensary Service.

The DIRECTOR OF HEALTH, CHARITIES, AND CORRECTIONS.

Number of patients who were under treatment at the close of the last fiscal year and since cured, practically cured, under treatment, ceased to return, and died during this year.

Dispensaries.	Cured.	Practically cured.	Under treatment.	Ceased to return.	Died.
Adjuntas	97	9	76	12	.....
Aguadilla	28	33	388	25	.....
Albonito	279	21	191	40	2
Añasco	39	101	436	73	.....
Barranquitas	6	.....	.....	5	.....
Barros	42	.....	62	.....	.....
Cabo Rojo	22	44	6	33	.....
Camuy y Quebradillas	375	47	61	122	.....
Cayey	30	5	2	10	.....
Ciales	29	25	750	70	1
Cidra	10	3	44	6	.....
Coamo	10	13	14	13	.....
Comerio	232	97	33	185	.....
Corozal	251	155	95	42	.....
Fajardo	.....	21	12	1	.....
Guayama	9	38	38	44	1
Gurabo	2	5	.....	.....	.....
Hatillo	.....	.....	4	.....	.....
Humacao	2	.....	.....	.....	.....
Isabela	28	11	77	24	.....
Juana Diaz	155	63	75	13	.....
Juncos	153	117	9	9	.....
Lares	44	22	16	12	.....
Las Marias	1	24	7	.....	.....
Mayagüez	.....	.....	30	.....	.....
Manatí	212	47	1,271	19	1
Maricao	26	101	53	18	2
Maunabo	32	15	19	42	.....
Moca	2	1	.....	.....	.....
Patillas	32	.....	49	13	.....
Peñuelas	5	48	35	20	.....
Ponce	59	137	27	14	.....
Rio Piedras	26	17	.....	.....	.....
Rincon	.....	.....	5	1	.....
San German	107	49	65	2	.....
San Sebastian	81	66	33	66	.....
Vega Baja	44	11	33	18	1
Yabucoa	39	.....	38	2	.....
Yauco	68	7	158	85	.....
Total	2,577	1,353	4,182	1,039	8

SUMMARY OF FORTHCOMING REPORT FOR 1909-10.

(Dr. Pedro Gutierrez Igaravidez, director of the service.)

AN ACT To promote the study and prevention of tropical and transmissible diseases, and to continue the work of suppression of uncinariasis.

Be it enacted by the Legislative Assembly of Porto Rico.

SECTION 1. For the purpose of fostering the study and measures tending to prevent the tropical and transmissible diseases in this island and of continuing the work of stamping out the disease known as tropical anemia or uncinariasis, there shall be created by this act, in the department of health, charities, and corrections, a special medical service, to be known as tropical and transmissible diseases service, consisting of a director, who shall be a licensed physician, and of such expert and clerical force as may be considered necessary for the administration of said service, and of as many physicians as may be necessary.

SEC. 2. The director of said service shall be appointed by the director of health, charities, and corrections, and shall hold office during good behavior as provided by the civil-service act, and, until otherwise provided by law, he shall receive a salary of three thousand dollars per annum. The director of the service shall appoint, by competitive examination and in accordance with the civil-service act, a pathological physician for each one of the seven districts into which the island is divided, with an annual salary of one thousand five hundred dollars, and as many physicians as may be necessary to install and direct the dispensaries in those towns where they are most needed, in the opinion of the director. The salary of these physicians shall be determined by the director according to the work assigned to each physician. Said pathological physician shall have all the powers and perform all the duties provided for by section 5 of the act entitled "An act to authorize the director of health, charities, and corrections to contract for the care of tuberculosis patients in the hospitals and sanatoriums of the antituberculosis league, and for other purposes," approved March eleventh, nineteen hundred and nine.

The director of the service shall also appoint, under the civil-service acts and regulations, an assistant to each district commissioner, with a salary of three hundred dollars per annum.

SEC. 3. It shall be the duty of the director of the tropical and transmissible diseases service to use every means at his command to prevent, fight, and stamp out the disease known as uncinariasis, and to direct his own endeavors and those of the commissioner and other physicians of the service toward the advancement of the study and investigation of tropical and transmissible diseases, examining and collecting specimens, preparing statistics of diseases and deaths, and giving out such information as will offer the means to know and avoid said diseases, for which purpose he is charged with the creation and maintenance of a central office for the administration of the work, with the following as his assistants: A bacteriologic physician, who is to be an assistant to the director, with a salary of two thousand dollars per annum; a chief clerk at one thousand dollars per annum; a clerk with a salary of nine hundred dollars per annum; a physician, assistant director, at one thousand two hundred dollars per annum; a clerk with seven hundred and twenty dollars per annum; a typewriter with six hundred dollars per annum; a messenger and laboratory servant with three hundred and sixty dollars per annum; all of whom shall be appointed by the director of the service, under the provisions of the civil-service act and regulations of Porto Rico.

SEC. 4. It shall be the duty of the director to open four dispensaries at the capitol in towns of each district, whose municipality shall furnish suitable quarters for the installation of an office and as many other dispensaries as may be required to meet the needs of the service in different towns of the island.

SEC. 5 The district physicians and the other physicians attached to this service shall carry out all the instructions originating from the director of the service and shall be responsible to the director for the medicines and other supplies intrusted to them.

SEC. 6. It is hereby expressly provided that the provisions of section one hundred and seventy-seven of the political code are hereby suspended in so far as to permit "médicos titulares" already paid by the towns to receive a further compensation from the insular government for the work above stated.

SEC. 7. In each municipality wherein a dispensary may be established there shall be created an advisory board composed of the alcalde, the health officer, or a pharmacist, and the president of the school board of such municipality, whose duty it shall be to inspect and report to the director upon the work of the dispensary at least once each month, with recommendations which, in their opinion, could be adopted for the more perfect working of the said dispensary: *Provided*, That at the end of the fiscal year the consulting board shall send to the director of the tropical and transmissible diseases service a report of the work done by the local dispensary stamping out uncinariasis, including a project for the construction in the fields of Porto Rico of rustic cesspools, which economically but effectively shall prevent the spreading out of materials serving as vehicles of contagion.

SEC. 8. The work of the organization herein created shall be under the direct supervision of the director of health, charities, and corrections, whose approval of all regulations of the service, of appointments of physicians and assistants, and of the expenditure of money placed under the direction of the director of the tropical and transmissible diseases service shall be required.

SEC. 9. All the property and files acquired by the director of the anemia service, under the provisions of the "act to provide for the continuation of the work of the suppression of the tropical anemia or uncinariasis in Porto Rico," approved September eighteenth, nineteen hundred and eight, and those acquired under this act for the same service shall be turned over to the director of the tropical and transmissible diseases service, and shall by him be utilized where it may serve the interest of the service and in compliance with the provisions of this act: *Provided*, That for the purpose of completing the clinic laboratory to be used in this service the director thereof is hereby authorized, on the approval of the director of health, charities, and corrections, to obtain from the insular chemical laboratory such apparatus and utensils as may not be necessary for the investigations of the said laboratory.

SEC. 10. No money shall be expended for the construction, rent, or repair of buildings to be occupied as dispensaries; but the director of the service may incur such expenses as may be found necessary for the establishment of their office and laboratory.

SEC. 11. To carry out the purposes of this act there is hereby appropriated out of any money in the Treasury not otherwise heretofore appropriated, for the fiscal year ending June thirtieth, nineteen hundred and ten, the sum of thirty-six thousand dollars, or so much thereof as shall be necessary.

SEC. 12. That an "act to provide for the continuation of the work of the suppression of tropical anemia or uncinariasis in Porto Rico," approved September eighteenth, nineteen hundred and eight, and all other laws or parts thereof in conflict with this act are hereby repealed.

SEC. 13. This act shall take effect after the first day of July, nineteen hundred and nine.

Approved, March 16, 1909.

The legislature of 1909 modified the law by which the anemia dispensaries were governed and, with the object of extending the investigations so far made into a broader field of action, passed a law "to promote the study and prevention of tropical and transmissible diseases and to continue the work for the suppression of uncinariasis." This law had two objects:

1. The organization of sanitary districts for the investigation and prevention of those diseases, placing a physician in charge of each, who should be specially fitted for laboratory work and to whom the various municipal physicians might apply for a microscopic corroboration of their diagnoses.

2. The establishment of central or departmental stations for the direction of the uncinariasis work, which was being carried on in the dispensaries of the subsidiary towns, and the supply of such dispensaries with medicine and other necessary articles.

To direct this work, a central office was established in San Juan, with its bacteriological laboratory, where investigations could be made which required a special technique and special apparatus not in current use in a clinical laboratory.

In accordance with this law, and after competitive examination, seven physicians were appointed for the seven districts of the island and one bacteriologist for the central office. Under the seven district chiefs were 55 anemia dispensaries, which treated, in all, 37,880 persons, in addition to 9,862 remaining for treatment from last year. The district chiefs were required to open their offices in the district capitals, San Juan, Ponce, Mayagüez, Arecibo, Aguadilla, Humacao, and Guayama. These offices were dispensaries for out-patients suffering from uncinariasis and from tuberculosis and were, in addition, laboratories for such other investigations as might be required of them by municipal physicians.

Here bacteriologic examinations of sputum were made for cases of suspected tuberculosis, with a physical examination of the patient, his inscription on a clinical card separate from that used for other diseases, and in case of a positive finding, his treatment and necessaries for the avoidance of contagion, such as pocket spit cups, antiseptics for the clothing, and personal utensils, etc.

Each dispensary had a visiting nurse for tuberculosis cases, who went from house to house where patients under the care of the dispensary physician reside, taking care to see that remedies applied and personal hygiene prescribed are properly applied and superintending the execution of measures counseled for the prevention of the disease. This nurse carried her record of daily work to the district physician.

The service had also under its care the matter of admission to and discharge from the sanatorium of the Antituberculosis League of Porto Rico.

At the end of the fiscal year the district chiefs were required to make a visit of inspection to each one of the towns in their jurisdiction, and the service thus knows fairly well the conditions under which this new sanitary movement is developing and how the first steps are being taken in the struggle against anemia and tuberculosis. The service finds that it has about systematized microscopic examinations, serum reactions, and other duties of a clinical laboratory requested of the district and central laboratories by the physicians of the island and feels that it has responded with efficiency and promptness to the demands made upon it. The medical officers of this service have thus aided the bureau of health of the island without interfering with its jurisdiction, and yet have investigated all diseases which have from time to time appeared or which have heretofore existed on a large scale to constitute a menace to the public health, recommending the preventive measures to be taken in each case.

In brief, the service of tropical and transmissible diseases came into the public life of Porto Rico—

(1) To supply the bureau of health with a corps of physicians especially trained in the pathology of tropical and transmissible diseases.

(2) To facilitate to the medical men of the island, especially to those practicing in the little towns and the country, a means for microscopic corroboration of their diagnoses.

(3) To establish dispensaries for the treatment of tubercular outpatients, and thus give primary instruction in prophylaxis, with a visiting nurse to act as a special police for antituberculosis work.

(4) To continue the work of the extermination of anemia in nearly all of the towns of the island by means of the dispensaries.

(5) To lay the foundations for a campaign for the prevention of transmissible diseases, which should be the object of every modern sanitary organization.

The summary of the cases treated in this year's work appears in another part of this work. The following is a list of the dispensaries:

Stations for the treatment of anemia in operation during the fiscal year 1909–10.

1. Estación de Adjuntas.
2. Estación de Aguada.
3. Estación de Aguadilla.
4. Estación de Aguas Buenas.
5. Estación de Albonito.
6. Estación de Añasco.
7. Estación de Arecibo.
8. Estación de Arroyo.
9. Estación de Barranquitas.
10. Estación de Barros.
11. Estación de Bayamón.
12. Estación de Cabo Rojo.
13. Estación de Caguas.
14. Estación de Camuy.
15. Estación de Carolina.
16. Estación de Cayey.
17. Estación de Ciales.
18. Estación de Cidra.
19. Estación de Comerío.
20. Estación de Corozal.
21. Estación de Fajardo.
22. Estación de Guayama.
23. Estación de Guánica.
24. Estación de Gurabo.
25. Estación de Humacao.
26. Estación de Isabela.
27. Estación de Jayuya.
28. Estación de Juana-Díaz.
29. Estación de Juncos.
30. Estación de Lares.
31. Estación de Lajas.
32. Estación de Manatí.
33. Estación de Maricao.
34. Estación de Maunabo.
35. Estación de Mayagüez.
36. Estación de Moca.
37. Estación de Morovis.
38. Estación de Naguabo.
39. Estación de Patillas.
40. Estación de Peñuelas.
41. Estación de Ponce.
42. Estación de Quebradillas.
43. Estación de Río Grande.
44. Estación de Río Piedras.
45. Estación de Sabana Grande.
46. Estación de San Juan.
47. Estación de San Germán.
48. Estación de San Sebastián.
49. Estación de Salinas.
50. Estación de Trujillo Alto.
51. Estación de Vega Alta.
52. Estación de Vega Baja.
53. Estación de Yabucoa.
54. Estación de Yauco.
55. Estación de Loíza.

A PLAN FOR COMBATING UNCINARIASIS IN PORTO RICO.

While this is decidedly the most important chapter in this work, after that which has gone before, there is no need to make it a long one, for the reports of the commission have clearly defined the reasons for recommendations under this heading.

As in previous years, there are only two feasible means of controlling uncinariasis in Porto Rico:

1. By treating the infected.
2. By educating the people to avoid infection.

For now six years the Porto Rican people have sustained a special medical service for the purpose of combating "anemia." The result has been seen. But special medical services are expensive, and the creation of one medical service here and another there is a waste of good energy, an unnecessary expenditure of money, and source of friction leading to confusion of authority and loss of momentum.

From the very first the men who composed the commission were of the opinion that this work should be undertaken by the insular health service, but the lack of authority over local health conditions, the lack of funds with which to work, and very many other important considerations compelled us to advise a separate service. We now renew our recommendation that the work against uncinariasis be continued in the future under a centralized organization, a department of public health. Under anything less than a centralized health service, whose officers are health officers of the various municipalities, paid by insular funds, and directed by a medical chief, the campaign against uncinariasis would be more costly and not as efficient.

The unit best adapted for a successful attack upon the disease has been the "anemia dispensary," and every town on the island has had one. From it has proceeded treatment of sick and propaganda by placards, pamphlets, and direct personal counsel to those who sought their health at the station. Now, however, we feel that the scope of this work must be broadened. If we compare the activity of a station to-day with what it used to be in 1906–7 we will find a falling off in the attendance. This is not due to lack of interest, but to the fact that the dispensaries are beginning to exhaust the numbers of infected in the regions they serve—regions whose radius is usually about 3 miles, although sick are still attracted from much greater distances in individual instances at all stations. Thus the town and its near-by barrios are freeing themselves rapidly of "anemia," thanks to those dispensaries. The great mass of anemics is now in the hills, where only a tithe of the population have received treatment for uncinariasis on account of the distance to be covered to reach the station. We are face to face with the absolute necessity for advancing if we ever expect to contribute in the labor of building up the agricultural interests of the island, apart from the saving of life and the restora-

tion to health of the most helpless portion of the population of the island, which latter desideratum is alone enough to commend us to put forth still greater effort. We must go up into the hills by means of an ambulant service and treat with these people in their respective barrios. As the work of the dispensaries should always remain the unit upon which all local work will depend, these must be sustained, but in order to avoid raising their cost beyond a figure which would not justify their continuance for uncinariasis alone, the control over all transmissible diseases of the municipality should be assigned them. This is actually being carried out by Dr. Gutierrez, who, as chief of the tropical and transmissible diseases service, is extending the sphere of action of each of his dispensaries along these lines, with one district chief to each of the seven districts in the island to supervise the work. These dispensaries are to-day, and should be in the future, true mission stations for hygienic reform.

The commission has literally revolutionized the system of medical aid to the poor. Heretofore the medical officer of the town was sought at all hours and in all places for a prescription. Thereafter the poor procured the medicine as best they could. It was the "prescription," however, that was prized. With the dispensary of the commission came regular hours for consultation, surety of receiving the medicine prescribed, and personal contact of the medical officer with a group of people eager to learn how to avoid preventable disease. All of this really lightened the work of the doctor and assured the patient of a place where he might conclude promptly with the business that brought him to town.

Now, precisely the most important part of work tending toward the prevention of communicable disease is the educational feature and such work must be personal, direct. To succeed one must make the dispensary attractive, one must listen attentively to each applicant, that future confidence in the doctor be established. This mission station for sanitary reform should be made the objective of every man, woman, and child in the municipality when they want medical advice. If the case is such as to fall outside of those diseases which are classed as transmissible they could easily be referred to the municipal physician and the municipality could care for its case. At this dispensary all deaths should be registered and thus more accurate statistics would be obtained, as such registration could be made at the fixed hours the physician in charge would be in attendance. The dispensary should be open at all times and two "practicantes" (a title conferred whose value approximates that of a sergeant of the Hospital Corps in our Army) should be connected with it, one of whom should always be in attendance during the day. The health officer of the municipality should spend at least two hours of each day save one, in the dispensary and those hours should be fixed. On the excepted day this officer, accompanied by a practicante and taking a portable microscope, thymol or beta-naphthol in capsules, sodium sulphate ready for dispensing in packages, and the record cards necessary, should visit the barrios. It would be perfectly feasible for him to make out an itinerary covering all the barrios in his jurisdiction, notifying the barrio alcalde (barrio chief) of the day and hour of his visit, and requesting that person to advise all sick to present themselves at some specified place for treatment.

Having held his little clinic, given a short talk on some branch of preventive medicine, and notifying those present of his intention to return, etc., he should devote the rest of the day in thoroughly informing himself of the health conditions of the barrios he visits, hearing complaints, visiting points of special sanitary interest, etc.

Thus attending to the needs of one barrio or even two one week, another or others the next, he would, in two or three months, complete his rounds. Of course there are municipalities which have more than 12 barrios, and to such an assistant health officer should be assigned. After the first visit of the doctor, who should in person make the diagnosis and prescribe the treatment, the practicante should return every 10 days to renew the medicine prescribed until five doses of the anthelmintic have been administered, when the patient should be either advised to await the return of the health officer or, in view of much improved health, be urged to visit the dispensary in the town to verify his cure by a microscopic examination of the feces. In this manner an ambulant service could be supplied at a minimum expense, the health officer would be brought into intimate contact with the people over which he is supposed to-day to exercise sanitary control, and the people themselves would be instructed in the prevention not only of uncinariasis but of all preventable diseases which threaten them, besides acquiring the habit of looking to the health officer as the true guardian of their physical well-being.

To make this hard service more palatable and to provide for necessary expense of transportation, the health officer should either receive for these trips a per diem allowance for expenses or his transportation. The part of the planter in this work is a very important one. Head as he is of a community of working people, his advice, nay, his orders, would be far more readily obeyed than statutes of law. When the health officer effectually carries out his mission it will not be long before we may see a little extra pay added to the wage on condition that shoes are used. Indeed shoes might easily be kept for sale at cost price in the plantation stores of some large estates. Earth pollution will be restricted, inspection of huts will be made, and a lively interest in the physical condition of laborers will be the fruit of the labors of the municipal health officer, provided that he will throw into it his personality and the cooperation of the landowner be generously given him in his work. We are thoroughly opposed to legislation which would attempt to compel the use of shoes, and we are still in much doubt as to the form a law should take prohibiting earth soiling. Our campaigns have always been made with the good will of the Porto Rican people to help us. The time is not yet ripe for punitive measures, and we would regret seeing a law enacted that would have to remain unenforced upon the statute books.

To repeat all other measures counseled for the prevention of uncinariasis in the reports of the commission would be to uselessly consume time and space. If we have been able to make clear our viewpoint, that it is preferable to induce people to do for themselves what laws alone can not compel them to do, we shall feel that this chapter has not been written in vain.

APPENDIX.

APPENDIX.

The appendix contains the case histories of the patients who were made the subject of special study in the first three years of the campaign against uncinariasis, besides those of 1899 and 1902, which formed the basis for that campaign. Those of 1899, 1902, and 1904 have already been published, but it is necessary for us to reproduce them here, as they are not only out of print, but, as far as the most important series are concerned, were given exceedingly limited circulation. The series for Aibonito and for Rio Piedras have never been published and are really the most instructive, as they furnish data of great value for any work which contemplates the treatment of large numbers of sick as a means of eradicating the disease in its endemic form.

There are over 30,000 clinical cards of our patients for 1905 and 1906, which are incomplete as to their detailed histories, but which contain valuable etiologic data and which describe the system or systems most affected by the disease, together with all unusual symptoms and a very full account of the treatment and the result obtained. The compilation of this data is, however, a work of a long time, and in the midst of a struggle to gain the mastery over an endemic that still enslaves 300,000 people it is manifestly impossible to reflect very long on what has been done in the past. The records are being kept, however, and may some day be of interest. For the present needs of this hurried compilation of our five official reports the following case histories will be sufficient to very faithfully reflect the types of uncinariasis which one may chance to see.

THE PONCE SERIES OF 1899.

Upon the study of these cases the anemia of Porto Rico was found to be uncinariasis. Many of the details of the case histories are omitted for the sake of brevity, but enough are retained to elucidate each case. When the first blood records, etc., were made, the cause of the disease was entirely unknown, and until the latter part of November cardiac stimulants and iron and arsenic were the chief drugs used. In a few recounts an instructive lesson is given of the futility of mere "tonics" in uncinariasis. Later thymol began to be employed by Dr. Ashford, but as he left the island in December the succeeding history of these unfortunates is not known. All of the cases were studied in November of 1899.

Polychromatophilia, poikilocytosis, and abundance of macrocytes and microcytes were found in nearly all; in fact, the only one in which these were not present was case 16.

The type is seen to be severe.

Case number.	Red cells.	Hemoglobin percentage.	Leucocytes.	Per cent polymorphonuclears.	Per cent small lymphocytes.	Per cent large lymphocytes.	Per cent eosinophiles.	Normoblasts per cmm.	Megaloblasts per cmm.	Résumé of history.
1	1,530,116	20	6,800	65	21	9	5	26	13	White, male, age 14; extreme pallor; edema general; great dilatation heart; edema lungs; liver much enlarged; constipation; temperature 101.6. Recount of blood 19 days later: Hemoglobin, 16 per cent reds, 1,880,000.
2	697,776	20	7,960	59	17	15	9	144	46	White, male, age 42; ill three years; extreme pallor; great emaciation; ulcers leg and corneal ulcers both eyes. Temperature normal to subnormal. Recount of blood 20 days later: Hemoglobin, 23.5 per cent; reds, 2,664,440.
3	1,533,112	22	2,000	64	22	8	6	8	.....	White, male, age 25; very pale; emaciated; ulcer leg; heart dilated; lungs edematous; spleen greatly enlarged; constipated; temperature irregularly between 98 and 99; joint pains. Recount of blood 19 days later: Hemoglobin, 23 per cent; reds, 1,973,328.
4	1,200,000	15	4,200	64	23	6	7	109	8	White, male, age 49; pasty yellow color; emaciated; marked edema legs; heart dilated; veins swollen and little knots over valves in brachials; pulse 64, weak, intermits every 5 beats; edema lungs; temperature between 98 and 100. Recount of blood 18 days later: Hemoglobin, 17.5 per cent; reds, 801,104.
5	1,484,440	10	6,000	64	24	8	4	12	.....	White, male, age 25; does not remember the time when he was well; grayish yellow pallor; can hardly understand the simplest questions; insomnia; craving to fill stomach; alternates between diarrhea and constipation. Recount of blood 17 days later: Hemoglobin, 14 per cent; reds, 687,776.

Case number.	Red cells.	Hemoglobin percentage.	Leucocytes.	Per cent polymorphonuclears.	Per cent small lymphocytes.	Per cent large lymphocytes.	Per cent eosinophiles.	Normoblasts per cmm.	Megaloblasts per cmm.	Résumé of history.
6	2,193,328	23	8,800	65	26	8	1	123	35	White, male, age 25; has had anemia 19 years; lemon-yellow color; insomnia; edema both legs; so weak that he has to be carried to place of examination; dyspnoea so severe as to prohibit the slightest movement; dilated heart; temperature 100.2; nausea, vomiting, and constipation.
7	1,633,328	17	5,600	60	23	5	12	11	.....	White, male, age 33; always anemic; marked pallor; emaciation; pot-belly marked; slight edema legs, penis and scrotum, left foot, and wrist; pulsation brachial veins; liver dullness increased; heart dilated.
8	2,064,664	23	4,800	74	17	6	3	28	.....	White, male, age 55; marked pallor; immature cataract both eyes; pulsation brachial veins; heart dilated; pulse weak and intermits every fifth and seventh beat; liver dullness to 3 inches below ribs; temperature 99.6. Recount of blood, 15 days later: Hemoglobin, 31 per cent; reds, 3,084,440.
9	1,271,104	14	7,800	60	17	6	17	30	15	White, male, age 32; 2 years sick; pasty yellow pallor; edema of right arm, forearm and hand and of both feet and legs; ulcers both legs; general pulsation veins; heart dilated; temperature 99.1; constipation. Recount of blood, 16 days later: Hemoglobin, 24 per cent; reds, 2,500,000.
10	1,600,000	17	1,500	72	20	4	4	6	.....	Mulatto, male, age 25; 2 years sick; yellow, pasty pallor marked; insomnia; pulsation veins; heart area enlarged; temperature irregularly between 97 and 99; nausea, vomiting; inordinate craving for food; constipation. Recount of blood, 17 days later: Hemoglobin, 13 per cent; reds, 668,880.
11	1,800,000	25	4,600	69	22	7	2	9	.....	Negro, male, age 54; 19 years sick; all circulatory symptoms with badly involved heart; nausea, vomiting, constipation; intense yellow pallor; edema lower extremities.
12	2,266,656	30	7,680	52	26	12	10	.....	.....	Negro, male, age 16; sick 6 years; moderate grade of symptoms, all systems; liver and spleen enlarged.
13	1,268,888	20	6,800	63	17	7	13	.....	.....	White, male, age 47; 9 months sick; decided pasty pallor; pot-belly; no edema; heart dilated with enlarged liver; temperature 99.8; otherwise usual symptoms.
14	2,440,000	25	11,000	50	10	9	31	.....	.....	White, male, age 22; disease began 1 month ago; dizziness, headache, tinnitus aurium; insomnia; high degree emaciation; great pallor skin and mucous membranes; pulsation veins; heart much enlarged; cardiac dilatation; loud murmurs all over heart; pulse 84, weak, compressible; temperature 100.4; nausea, pain in abdomen, constipation; dullness over entire right lung with small moist râles on this side, and increased resonance and bronchial breathing. Liver greatly enlarged and tender; history amebic dysentery. Diagnosed abscess liver but not proven, owing to patient's refusal operation and leaving camp. This diagnosis doubtful now in view of history. A case of true acute uncinariasis.
15	2,353,328	17	12,700	73	17	4	6	.....	.....	Negro, male, age 18; 2 years sick; usual involvement of all systems.

Case number.	Red cells.	Hemoglobin percentage.	Leucocytes.	Per cent polymorphonuclears.	Per cent small lymphocytes.	Per cent large lymphocytes.	Per cent eosinophiles.	Normoblasts per cmm.	Megaloblasts per cmm.	Résumé of history.
16	2,934,444	.....	5,200	72	20	5	3	10	10	White, male, age 41; 1½ years sick; no edema; hypertrophy heart; usual symptoms save lungs where consolidation was noted over entire right side, probably tubercular. Has abundant tertian malarial parasites in blood.
17	2,140,000	23	18,000	40	12	8	40	36	.....	Negro, male, age 18; marked ascites; heart normal; pallor marked; pulse weak and intermittent. Lungs: Dullness right apex and both bases diffuse moist râles, large and small, heard all over chest; fine crepitant râles right upper lobe; breathing rapid and thoracic. Temperature 101.4 Lobular pneumonia.
19	(1)	30	9,000	60	16	10	10	125	.....	White, female, age 40; had no pronounced symptoms until about 6 months ago, but has been anemic 10 years. Well developed; muscular tissues soft and doughy; complexion sallow; appearance bright; headache; no gastric affection; always tired on slightest exertion; sleep irregular; menstruation always regular, but very watery; pain in left arm and leg; no murmurs in heart; pulse weak and thready; liver much enlarged, also spleen. No symptoms from degestive system save constipation.
20	1,560,000	16	2,400	72	10	5	13	.....	.....	Mulatto, male, age 22; always in good health until about 1 year ago; is like a waxen image; liver and spleen enlarged and tender. Rest of picture that of severe case.

[1] Unknown.

THE PONCE SERIES OF 1902.

These cases were studied by Ashford and King and published in "American Medicine" (Sept. 5 and 12, 1903, Vol. VI, Nos. 10 and 11, pp. 391–396 and 431–438). Nineteen of them were very complete in symptomatology and are used in this work to assist in forming a basis for a summary of the clinical features of the disease. Such cases are Nos. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 23, 26, 51, 52. The entire series of 100 cases are divided into two groups:

First group.—These are cases in which the blood records are complete for red and white cell counts, hemoglobin percentages and differential counts of leucocytes. In addition, the case histories are much more detailed.

Second group.—Cases in which only a brief summary of the type of case is given and the hemoglobin and differential counts.

The first group comprises the graver cases.

First group.

Case No.	Date.	Name, age, sex, color.	Residence, occupation, etc.	Symptoms.	Date of blood examination.	Red cells per cubic millimeter.	Per cent hemoglobin.	Leucocytes per cubic millimeter.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Remarks.
1	1902. July 2	Juan S., 27 years, male, white.	Lowlands; laborer coffee and sugar plantations.	Some edema of feet; reduced sexual powers; usual cardiac symptoms, with hypertrophy and throbbing cervical vessels; disorders of digestion, nausea and vomiting; apathetic; marked pallor.	July 8 Oct. 17	1,751,940 4,110,000	10 70	7,200	60	20	8	12	Cured; no symptoms remaining.
2	June 28	Joaquin C., 22 years, male, white.	Highlands; laborer coffee plantation.	Nearly moribund; tremendous ascites; edema face and legs marked; usual cardiac symptoms marked; severe pains in chest; extreme throbbing of cervical vessels; marked digestive disorders; impotent; burning of palms of hands and soles of feet; knee jerk diminished; extreme pallor; thrill in right clavicular region; somnolent.	July 1 Aug. 22 Dec. 15 Jan. 20 Mar. 10	1,458,200 2,772,800 4,332,800	8 18 38 52 60	5,800 5,200	73 53 ..... 60.5	13 22 ..... 18.5	2 4 ..... 8	12 21 ..... 13	Cured; was believed a hopeless case by Porto Rican hospital nurses, who told us that such patients always died. Became perfectly well and is now working energetically at heaviest labor without fatigue.
3	July 1	Juan G., 9 years, male, white.	Highlands; coffee picker and sugar plantation hand. Father dying of anemia in another ward.	Pronounced ascites; edema hands, feet, legs, face, and prepuce; no heart murmur, but undulating precordia and supraclavicular spaces with thrill; indigestion; vomiting; marked apathy; numbness of extremities; much albumin in urine, and a few casts—granular; great pallor.	July 11 Aug. 24	1,306,664 2,755,200	15 46	3,800 2,000	78 66	17.2 19	2.8 3.5	2 11.5	Left hospital with no symptoms save a little weakness, but through a mistake no reexamination of his blood was made; can be counted as probably cured.
4	July 7	J. Cruz S., 10 years, male, white.	Highlands; coffee picker; father very ill with anemia.	Ascites; edema in legs; usual cardiac symptoms with hypertrophy; indigestion; apathy and stupidity; knee jerk diminished; is very waxy pale.	July 7 Aug. 22 Oct. 15	2,802,160 4,806,400 4,942,000	51 74 75	7,000 3,000	..... 42	..... 15	..... 5	..... 38	Cured completely; no signs remaining of the disease; has active work; is ruddy and fat.
5	June 28	Jose S., 26 years, male, mulatto.	Lowlands; laborer; many of family anemic; had malaria.	Indigestion but slight; heart normal; albumin in urine and a few hyalin casts, renal cells, and many crystals of calcium oxalate; pallor; diminished sexual powers; not a severe case.	July 5 Nov. 11	2,408,000 5,413,328	29 94	7,400	74	22	3	1	Cured; now at hard work; squat crescents of quotidian estivo-autumnal malarial fever abundant on admission.

First group—Continued.

Case No.	Date.	Name, age, sex, color.	Residence, occupation, etc.	Symptoms.	Date of blood examination.	Red cells per cubic millimeter.	Per cent hemoglobin.	Leucocytes per cubic millimeter.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Remarks.
6	1902. July 14	Pedro L., 45 years, male, white.	Highlands; carpenter; many of family have anemia.	Edema of feet; cardiac symptoms extreme; undulating cervical vessels; slight digestive disorders—stomatitis; numbness of extremities; great pallor.	July 14 Oct. 25 Jan. 21	1,341,600 4,297,400	15 55 66	5,000	....	....	....	....	Cured; now working hard; all symptoms have disappeared.
7	Jan. 15	Eladio V., 26 years, male, white.	Highlands; beggar; too weak to work; plantation hand.	Completely impotent; extreme debility; digestion disordered; edema legs, scrotum, abdomen, and face; intelligent but without spirit; slight hemic heart murmur; large ulcer ankle.	Jan. 15 Feb. 8 Feb. 20 Oct. 28	2,700,000 3,778,000 3,996,000 4,960,000	35 60 96	12,400	....	....	....	....	Cured; now powerful and ruddy, doing the heaviest labor; was not admitted to hospital, yet was one of our worst cases.
8	July 1	Esteban G., 11 years, male, mulatto.	Highlands; coffee picker; both parents died—anemia.	Ascites and general edema; cardiac symptoms marked; throbbing cervical vessels; indigestion; apathetic; stunted mentally and physically; burning of palms and soles; sallow, waxy color; pustular eruption legs and arms, all stages development, with much itching; diminished knee jerk; spleen enlarged; history, malaria.	July 1 Sept. 11 Nov. 10	2,688,000 4,235,200 5,504,000	23 45 70	19,400 6,800	..... 37 56.5	..... 38.5 31	..... 12.5 5	..... 12 7.5	Cured; is now rosy and well and working on a sugar plantation; acute case.
9	July 9	Candelario, M., 27 years, male, white.	Highlands; laborer, especially in coffee plantations.	Marked edema; cardiac symptoms, with pulsating jugulars; physical signs, hypostatic congestion lungs; digestive disorders; apathy; insomnia; paresthesias; numbness extremities; knee jerk diminished; much neuralgia; great pallor.	July 9 Aug. 26 Oct. 27 Jan. 20	1,568,000 4,173,200 5,106,640	10 50 70 80	8,800	49 46 ..... 47.5	16.5 18 20	8 10 ..... 8.5	26.5 26 24	Cured; is now at hard work and has developed into a powerful man; all symptoms have disappeared; short time since first symptoms appeared.
10	July 15	Geronimo M., 30 years, male, white.	Highlands; laborer, tobacco and coffee.	Edema; no sexual desire; cardiac symptoms; disordered digestion; apathy; burning of palms and soles; exaggerated knee jerk; decided pallor.	July 15	3,008,880	33	3,400	.....	.....	.....	.....	No second blood record, as the man unexpectedly left hospital before it could be taken.
11	...do....	Melaton M., 20 years, male, white.	Highlands; coffee picker.	No sexual desire; indigestion; dense stupidity; not very pale; color more livid; heart normal.	...do.... Sept. 6	3,832,000 5,504,400	56 84	2,800 3,400	....	....	....	....	Cured; became an intelligent nurse in the hospital.

12	July 7	Francisco J., 31 years, male, white.	Highlands and lowlands, but chiefly latter; laborer; many of family died of anemia.	Has had malaria and dysentery; marked edema; loud heart murmur with enlargement and bruit in jugulars; gastric indigestion; extreme apathy; insomnia; paresthesias feet and numbness extremities; exaggerated knee jerk; very pallid.	July 7 Aug. 23 Dec. 12	1,842,400 2,772,800	10 18 30	2,200 5,200	.....	.....	.....	.....	Improved, but still far from well; is working, however, and says that he is a little better; heart improved.
13	July 11	Francisco A., 30 years, male, white.	Highlands; laborer.	Nearly moribund; intense vertigo and pallor; complete impotence; dilated heart; hypostatic congestion lungs; indigestion; vomits; apathy profound; somnolent; severe headache; burning of palms and soles; numbness of extremities.	July 11 Aug. 24 Nov. 14	960,640 2,666,400	10 34 44	4,800 6,800	70 55	18 23	5.5 6	6.5 16	Cured; left hospital improved and is often seen in streets, rosy and well; this case more than once about to be fatal.
14	July 13	Ramon de L., 46 years, male, white.	.....do	Ascites; much edema; impotent; cardiac symptoms; extreme cervical pulsations; indigestion; very stupid; apathy; numbness extremities; very pallid.	July 13 Oct. 25 Nov. 15 Dec. 27	1,448,000 4,256,640 4,635,520	12 60 55 60	2,200	61	21	6	12	Cured; total disappearance of all symptoms, but hemoglobin obstinately refuses to ascend.
15	July 2	Carlos G., 19 years, male, white.	Highlands; coffee picker.	Regarded hopeless; great edema; dilated heart; indigestion; vomits; stomatitis; melancholia; insomnia; paresthesias; numbness extremities; knee-jerk diminished; nystagmus; extreme pallor; ulcers on legs; much neuralgia.	July 2 Sept. 30 Oct. 18	904,370 4,144,400	12 67 96	5,000 6,000	..... 48.5	..... 24	..... 6.5	..... 21	Cured entirely save nystagmus. Has hard work on plantation now. Reported to us Oct. 18 and was not recognized, so rosy and fat was he.
16	Jan. 6	Jose G., 30 years, male, white.	Highlands; laborer in coffee, sugar, and tobacco plantations.	Indigestion; insomnia; great edema of feet; can not support family, owing to extreme debility; cardiac symptoms; undulating vessels; slow of speech; impotent; great pallor.	Jan. 6 Jan. 21 Feb. 4 Feb. 20	2,926,666 3,460,000 4,088,000 5,270,000	30 ..... 62.5 98	6,540	....	....	....	....	Cured; is working.
17	Sept. 4	Cardelio M., 12 years, male, white.	Highlands; too stupid to tell how disease began.	Some edema of ankle; bulging of precordia; dullness of heart area increased; noted over bulging; very soft, blowing murmur heard to left of sternum at third interspace; no neuralgic pains; slight pulsation of vessels of neck; knee-jerk diminished; white pallor of skin and mucous membrane; small ulcer on ankle.	Sept. 4 Sept. 28	2,397,760 4,257,760	32 60	3,800 3,000	62.6 64.4	28 24	4 6	5.4 5.6	Cured; very fat and has good color; fruit vender.
18	Sept. 7	Francisco A., 16 years, male, white.	Lowlands; first symptoms noted 8 years of age.	Edema legs; marked cardiac symptoms; slightly apathetic; has matured but little and appears 8-10 years old; indigestion.	Sept. 7 Dec. 14 Jan. 8 Apr. 1	2,353,280 ..... 4,231,040	14 60 62 70	4,600	59 ..... 65.5	23 ..... 18.1	3 ..... 7.4	15 ..... 9	Cured.
19	Sept. 10	Jose M., 27 years, male, white.	Highlands; laborer in plantations.	Extreme pallor; weakness, but has no edema; has malarial fever.	Sept. 10 Oct. 24 Nov. 1 Jan. 12	3,720,000 3,251,120	32 35 50 50	5,600 3,600	..... 43.6	..... 34	..... 6.4	..... 16	Much improved and at work. Obstinate malaria retards recovery.
20	Sept. 16	Jesus O., 25 years, male, mulatto.	Highlands and lowlands.	Weariness and edema of legs; indigestion; usual cardiac symptoms.	Sept. 16 Nov. 19 Jan. 9 Mar. 8	2,308,808 5,466,000	15 54 62 81	2,600	68	15	4	13	Cured and at work. Fat and rosy; no symptoms of anemia.

First group—Continued.

Case No.	Date.	Name, age, sex, color.	Residence, occupation, etc.	Symptoms.	Date of blood examination.	Red cells per cubic millimeter.	Per cent hemoglobin.	Leucocytes per cubic millimeter.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Remarks.
	1902.												
21	Sept. 16	Elenterio C., 46 years, male, white.	Lowlands; laborer in plantations.	Edema of legs; usual cardiac symptoms; very apathetic; reduced sexual power.	Sept. 16 Dec. 9 Dec. 29 Jan. 5	2,671,040	24 25 44 50	2,800	....	....	....	....	Much improved and working, but blood regeneration is slow and difficult, owing to age and probably organic lesions.
22	Sept. 16	Francisco C., 18 years, male, white.	Lowlands.....	Pain in stomach; much edema whole body and face; color typical; apathetic; reflexes almost extinguished; paresthesias and numbness of legs; reduced sexual power; heart, harsh murmur; severe case.	Sept. 1 Dec. 5	1,097,760	7 22	3,800	60.8	20	2.4	16.8	Died in Dec., 1902. Acute dilatation of the heart; no autopsy obtainable.
23	Sept. 2	Jose F., 29 years, male, white.	Lowlands; has been a farmer, but now a druggist, a well-informed man.	Ascites; edema of legs; impotent; cardiac symptoms; continual palpitation; irregular pulse; decided indigestion and pain in stomach; marked hypochondria even to point of melancholia; great debility; numbness of extremities; burning of palms and soles; excessive pallor; short time since disease began.	Sept. 2 Nov. 15 Dec. 15	3,668,880 5,831,040	28 68 85	5,000	55.8 48	19 25	4.3 5	21 22	Cured. This man has not only had a perfect return to health, but a deep ruddy complexion has replaced his extreme pallor.
24	Sept. 20	Eugenio R.....	.....	Most extreme degree of debility was seen in this case; the man could not raise his head from the pillow without violent and irregular action of the heart; great pallor.	Sept. 20	2,497,760	22	4,000	68.4	21.2	3.6	6.8	Suddenly died of acute dilatation of the heart, three weeks after admission.
25	Sept. 24	Jose M., 27 years, male, white.	.....	A case almost exactly the same as the last cited, plus an apparent peripheral neuritis with partial paralysis of lower extremities and absent knee-jerk; this is one of the cases which might be confounded with beriberi.	Sept. 24 Dec. 9 Dec. 29	2,833,280	16 29 65	....	....	....	....	....	Cured; a wonderfully rapid disappearance of heart signs, considering their serious nature. Pseudo-paralysis in legs has disappeared.
26	Oct. 12	Sixto M., 24 years, male, white.	Highlands; works in banana patches and coffee plantations; many deaths in family from anemia.	Ascites; edema of legs, arms, etc.; impotent; slight hemic murmur of heart; complains much of pains in heart area; slight indigestion; hypochondria, paresthesia; numbness of extremities; knee-jerk exaggerated; pallor typical; has ulcers on feet.	Oct. 12 Dec 9 Dec 15	3,587,880 4,826,640	45 58 70	3,400	....	....	....	....	Cured. Working.

27	Oct. 12	Pedro T.....	Highlands.....	Ordinary symptoms.....	Oct. 12	2,022,160	23	9,600	.....	.....	.....	.....	Cured.
					Nov. 8	5,504,000	65	.....	.....	.....	.....	.....	
28	Oct. 15	Unknown, age about 27 years, male, white.	Highlands; coffee laborer.	Admitted in the last stages; deathlike pallor, remaining in semistupor; when aroused, talked incoherently; a confirmed geophagist; usual symptoms pronounced.	Oct. 15	1,144,400	9	4,800	70	20	4	6	Died of exhaustion in about three weeks after admission.
29	Nov. 4	Oligario J., 23 years, male, white.	Highlands.....	Usual symptoms.....	Nov. 4	3,695,520	26	7,200	.....	.....	.....	.....	Cured. A severe case on admission. Working.
					Dec. 5	.....	47	.....	.....	.....	.....	.....	
					Dec. 29	5,146,640	70	.....	.....	.....	.....	.....	
					Jan. 13	.....	.....	.....	50.4	31.2	9.6	8.8	
30	June 5	Teleforo G., 20 years, male, mulatto.	Highlands; coffee laborer.	.....do.....	June 5	2,570,000	12	.....	.....	.....	.....	.....	Cured. Working.
					Sept. 2	.....	80	.....	.....	.....	.....	.....	
31	Oct. 18	Corsino C., 55 years, male, white.	.....	Usual symptoms; decided chronic gastritis and enteritis.	Oct. 18	3,082,400	36	4,400	70.8	14	2	13.2	Improved, but hemoglobin refuses to rise further.
					Dec. 8	.....	35	.....	.....	.....	.....	.....	
					Dec. 28	.....	50	.....	.....	.....	.....	.....	
60	Sept. 11	Maria R., 26 years, female, white.	Lowlands, domestic.	Amenorrhea; slight general edema; marked hysteria; paresthesia in legs; intense pallor; knee-jerk slightly exaggerated; paralysis apparently due to hysteria.	Sept. 11	4,960,000	33	3,400	45	17	5	33	Improved but little; tuberculosis of lungs.
					Sept. 12	4,800,000	31	.....	.....	.....	.....	.....	
					Nov. 20	.....	41	.....	.....	.....	.....	.....	
					Jan. 9	.....	44	.....	44	31	12	13	
					Feb. 3	.....	50	.....	.....	.....	.....	.....	
					Mar. 8	.....	45	.....	66	20	12	2	
61	Oct. 19	Maria R., 30 years, female, mulatto.	Lowlands; washerwoman and coffee picker.	Edema of legs and face; ascites; catarrhal stomatitis; apathetic; numbness of legs; paresthesia; apparent partial paralysis of lower extremities; reflexes diminished; impure first sound, but no heart murmur.	Nov. 3	4,260,000	54	6,400	31	12	3.5	53.5	Entirely cured; not a severe case and has not been ill long.
					Nov. 20	.....	57	.....	.....	.....	.....	.....	
					Jan. 13	.....	70	.....	42.5	28	7	22.5	
62	Oct. 29	Teresa G., 26 years, female, white.	Highlands; washerwoman and coffee picker.	Amenorrhea for four months; edema of legs; palpitation, but no heart murmur; numbness in legs and reflexes diminished; color typical; very apathetic.	Nov. 4	2,726,400	44	3,400	76	11.2	4	88	Cured.
					Nov. 20	.....	46	.....	.....	.....	.....	.....	
					Nov. 27	.....	56	.....	.....	.....	.....	.....	
					Jan. 8	.....	80	.....	.....	.....	.....	.....	
63	...do....	Antonio T., 26 years, female, white.	.....do.....	Indigestion; anesthetic spots, and apparent paralysis in the legs; greatly emaciated, pallid, and weak; no heart murmur.	Oct. 29	2,702,160	50	6,000	.....	.....	.....	.....	Died; tuberculosis of lungs.
					Nov. 20	.....	41	.....	.....	.....	.....	.....	
64	Oct. 31	Santiago T., 35 years, female, white.	Highlands; domestic and coffee picker.	Edema of legs, and sciatica of the right; pallor not severe; heart murmur.	Oct. 31	4,368,880	30	5,400	68.2	19.6	5.8	6.4	Cured.
					Nov. 20	.....	47	.....	.....	.....	.....	.....	
					Dec. 2	5,900,000	76	.....	.....	.....	.....	.....	
65	Nov. 4	Ingenia M., 30 years, female, white.	Highlands; coffee picker.	Usual symptoms marked; reflexes slightly diminished; soft blowing murmur heard.	Nov. 4	1,964,000	22	4,800	64	20.6	3.4	12	Cured; when admitted did not remember how many children she had.
					Nov. 20	.....	45	.....	.....	.....	.....	.....	
					Dec. 3	.....	69	.....	.....	.....	.....	.....	
					Dec. 17	4,140,000	.....	.....	70	22	3	5	
					Jan. 9	.....	81	.....	.....	.....	.....	.....	
66	Oct. 14	Angela R., 30 years, female, mulatto.	Highlands and lowlands; washerwoman and coffee picker.	Usual symptoms of moderate grade; has not been ill long	Oct. 31	3,317,760	25	5,800	58.2	20.2	4	17.6	Cured.
					Nov. 20	.....	46	.....	.....	.....	.....	.....	
					Dec. 2	.....	56	.....	.....	.....	.....	.....	
					Dec. 8	5,360,000	74	.....	.....	.....	.....	.....	
					Jan. 10	.....	80	.....	.....	.....	.....	.....	

First group—Continued.

Case No.	Date.	Name, age, sex, color.	Residence, occupation, etc.	Symptoms.	Date of blood examination.	Red cells per cubic millimeter.	Per cent hemoglobin.	Leucocytes per cubic millimeter.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Remarks.
	1902.												
67	Oct. 29	Maria S., 26 years, female, mulatto.	Highlands and lowlands; coffee picker.	Usual symptoms very marked; two attacks of malaria, one year previous; has not been ill long.	Oct. 29	1,124,400	11	7,800	53.3	15.1	4	27.6	Died of comatose form pernicious malarial fever in four hours; had improved wonderfully from anemia.
					Nov. 20	.....	40	.....	.....	.....	.....	.....	
					Dec. 2	.....	52	.....	.....	.....	.....	.....	
68	Oct. 11	Francisco R., 26 years, female, white.	Lowlands; housekeeper.	Usual symptoms marked.....	Oct. 11	1,737,760	15	8,200	72	16.4	6.8	4.8	Improving slowly of anemia; tuberculosis of lungs.
					Nov. 20	.....	20	.....	.....	.....	.....	.....	
					Mar. 8	.....	45	.....	70	18	3	9	
69	Oct. 27	Juana A., 60 years, female, white.	Lowlands; domestic.	Usual symptoms extremely marked...	Oct. 27	2,688,000	39	.....	58	30	5.6	6.4	Not improved.
					Nov. 20	.....	39	.....	.....	.....	.....	.....	
					Jan. 13	.....	50	.....	64	30	2	4	
70	Oct. 30	Anita O., 12 years, female, white.	Lowlands.....	Usual symptoms marked; decreased muscular power in arms and legs.	Oct. 30	1,764,400	21	7,200	38	42	5	15	Cured.
					Nov. 20	.....	64	.....	.....	.....	.....	.....	
					Dec. 6	5,132,000	70	.....	.....	.....	.....	.....	
					Jan. 9	.....	94	.....	41	39	5	15	
71	...do....	Maria O., 10 years, female, white.	.....do.....	Usual symptoms, but much worse than in her sister's case just cited; five brothers and sisters died of anemia.	Oct. 30	5,511,040	36	1,040	56	27	4	13	Do.
					Nov. 20	.....	68	.....	.....	.....	.....	.....	
					Jan. 8	.....	94	.....	59	14	6	21	

In case 25, the patient when addressed gazed stupidly at the speaker, then with a listless drawl, answered with apparent difficulty, pausing several seconds between each word. His answers showed such a lack of comprehension and memory that it was impossible to obtain an intelligible history of his case. Previous to admission, a diagnosis of peripheral neuritis with partial paralysis had been made.

In case 65, the patient laid down in the streets to die, but was picked up and brought to the hospital. She was not unconscious, but her conversation was very inaccurate and contradictory. There was great hypochondria and loss of memory; she did not remember her name, nor how many children she had borne. On questioning her after a few weeks' treatment, she laughed at her former statements, and gave a good account of herself. She stated that she remembered nothing of her entrance to the hospital, nor of our examination of her.

Second group.

No. of case.	Date.	Name, age, sex, and color.	Date of blood examinations.	Red cells per cubic millimeter.	Hemoglobin, per cent.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Symptoms and points bearing on case.	Remarks.
32	Sept. 1, 1902	Montserrate, P., white	Sept. 1		30					Residence in highlands; usual clinical symptoms.	Cured; blood not examined again.
33	Nov. 29, 1902	Juan O., 14 years, male, mulatto.	Dec. 9		24					Highlands; coffee picker; usual clinical symptoms.	Cured; no reexamination of blood after Jan. 13.
			Jan. 13		52	46	36	5	13		
34	Oct. 12, 1902	Jose R., 13 years, male, white.	Dec. 5		39					Same as last-cited case	Cured; no reexamination of blood further than last cited.
			Dec. 29		50						
35	Oct. 5, 1902	Carmelo M., 12 years, male, white.	Nov. 25		60					....do	Same as last-cited case.
			Jan. 29		70						
36	Oct. 17, 1902	Placido T., 47 years, male, white.	Dec. 5		24	54.5	29	14.5	2	Highlands; coffee picker; usual symptoms; unusually marked digestive symptoms due to chronic gastritis.	Improved; complication herein noted is responsible for his slow convalescence.
37	Nov. 23, 1902	Mateo R., 23 years, male, mulatto.	Dec. 9		69					Highlands; coffee picker and laborer on plantations; usual clinical history.	Cured; working.
			Dec. 25		102						
38	Nov. 19, 1902	Angel R., 14 years, male, white.	Dec. 9		26					Highlands; coffee picker; usual symptoms; severe case.	Cured.
			Dec. 29		30						
			Mar. 21		60						
39	Nov. 17, 1902	Claudino M., 15 years, male, mulatto.	Dec. 9		65					Highlands; coffee picker; usual symptoms	Much improved; working.
			Dec. 29		65						
40	Nov. 10, 1902	Alejandrino S., 18 years, male, white.	Dec. 5		32					Same as above	Cured.
			Dec. 29		32						
			Jan. 13		40	60	13.2	10.4	16.4		
			Feb. 2		52						
			Mar. 19		70						
41	Nov. 19, 1902	Juan S., 19 years, male, mulatto.	Dec. 9		25					Lowlands and highlands; coffee picker and sugar plantation hand.	Do.
			Dec. 29		30	41	30	8	21		
			Feb. 15		55						
			Mar. 5		80						
42	.....do.....	Andres C., 29 years, male, white.	Dec. 9		39					Highlands; works on coffee plantation; many eggs; case of moderate severity; usual symptoms; acute case.	Vastly improved, although hemoglobin does not show it; still under treatment, but working in hospital.
			Dec. 29		52						
			Jan. 13		48	14.5	13.5	5.5	66.5		
			Feb. 15		42						
			Mar. 12		40						
			Apr. 1		42	22	7	3	68		

Second group—Continued.

No. of case.	Date.	Name, age, sex, and color.	Date of blood examinations.	Red cells per cubic millimeter.	Hemoglobin, per cent.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Symptoms and points bearing on case.	Remarks.
43	Sept. 2, 1902	Pablo P., 40 years, male, white.	Dec. 5		60					Highlands; laborer; usual symptoms plus a pustular eruption on legs becoming crustaceous and itching intensely; a severe and typical case of uncinariasis, but blood record was not taken till three months after treatment had been instituted.	Cured; now employed in hospital, a powerful and ruddy man.
			Dec. 15		80						
			Dec. 29		85						
			Jan. 13		87	55	17.5	2.5	25		
44	July 14, 1902	Jose Mar., 49 years, male, white.	Dec. 5		33					Highlands; coffee picker; this man also began treatment long after (5 months) blood record was made; usual symptoms; two months after admission severe attack of acute dilatation of the heart appeared with congestion of lungs; rallied from this; in January diffuse fusiform swelling of both legs took place, disappearing on use of adrenalin chlorid; now dilatation of heart has returned.	Less anemia, but bad prognosis.
			Dec. 29		30						
			Jan. 13		44	55	18	13	14		
			Mar. 5		63						
45	Aug. 16, 1902	Wenceslao G., 29 years, male, mulatto.								Laborer; usual symptoms plus pulmonary tuberculosis.	Bad prognosis.
46	Nov. 19, 1902	Juan C., 32 years, male, white.	Nov. 19	5,533,660	52					Highlands; coffee picker; blood record about two months after institution of treatment.	Greatly improved; has gone to work.
47	Aug. 2, 1902	Antonio C., 77 years, male, mulatto.								Highlands; laborer; symptoms marked on admission.	Cured; now in excellent health.
48	Oct. 8, 1902	Spaniard, name unknown, about 32 years, male, white.	Oct. 8	3,126,640 [1] 4,600	40					Used to be a Spanish soldier, but became a farmhand here; usual symptoms plus pulmonary tuberculosis.	Died of tuberculosis.
49	Aug. 20, 1902	Elias R., 30 years, male, white.	Aug. 20	1,004,440 [1] 2,200	30	56.3	33.6	4.8	5.3	An Arab; intestinal tuberculosis and uncinariasis.	Died.
50	Jan. 12, 1902	Name not known, 19 years, male, mulatto.	Jan. 12	3,275,520 [1] 5,400	40					Lowlands; usual symptoms	Improving.
51	July 1, 1902	Astacio B., 48 years, male, white.								Lowlands; began as usual; sugar plantation hand; was a sailor until four years ago; circulatory and nervous symptoms very marked; extreme pallor.	Left hospital much improved, but finally had to be admitted to the insane asylum.
52	Oct. 12, 1902	Ignacio S., 16 years, male, negro.								Highlands; usual symptoms marked; color a peculiar dark gray.	Completely cured; color became normal dark brown.

53	Sept. 2, 1902	Ricardo R.								Usual symptoms	Cured.
54	Sept. 7, 1902	Dolores M.								Same	Do.
55	Sept. 8, 1902	Gregorio F.								do	Do.
56	Aug. 10, 1902	Name not known, 10 years, male, white.								Most extreme case; when brought in was nearly moribund; the chief point in this case was that the heart was dilated, accompanied by tremendous ascites and general edema; was several times necessary to draw off the fluid with trocar and canula and to scarify the scrotum and prepuce; face that of an old man and dyspnea was distressing; apparently in the last stages of organic heart disease.	Cured; left hospital while still in a deplorable condition and without permission; was thought to have died, but suddenly reappeared in March, 1903; no one recognized him and he had to make himself known; he is fat, strong, and healthy and has ruddy color.
57	Dec. 5, 1902	Francisco A., 49 years, male, white.	Dec. 5 Jan. 13 Feb. 15		15 20 32	55 52.5	20 21.5	7 10	18 16	Highlands; laborer; usual symptoms of severe degree; has chronic enteritis and low vitality.	Greatly improved; left hospital to go to work.
58	Aug. 5, 1902	Name not known, 10 years, male, white. This case to contrast with No. 56.								In a dying condition when admitted	Died ten days thereafter; autopsy notes elsewhere.
59	July 10, 1902	E. Flor., 19 years, male, white.								High degree of anemia and usual symptoms; extreme case; very melancholic.	Cured; a very successful case; is ruddy and well; selling wares in streets of Ponce.
72	Dec. 9, 1902	Name not known, 27 years, female, white.	Dec. 9	2,400,000	32					Very pronounced symptoms; headache intense; causes her to scream from pain.	Left hospital improved; now said to be well, but never seen again.
73	do	Maria C., 25 years, female, white.	Dec. 9 Jan. 10		51 90					Usual symptoms; intense headache and debility.	Cured.
74	Jan. 13, 1903	Bonifacio R., 10 years, female, white.	Jan. 13 Feb. 15		40 85	50	21.5	14	14.5	Usual symptoms; Acute case	Do.
75	do	Maria R., 25, female, white.	Jan. 13		45	81	12.5	1	5.5	Usual symptoms; no reexamination of blood made.	Do.
76	do	Belin R., 19 years, female, white.	do		35	62	10	28		Very extreme case; densely stupid, apathetic.	Died.
77	Nov. 16, 1902	Ramon M., 10 years, mulatto, male.	Dec. 29 Jan. 13		49 56	37.5	27.5	13	22	Bad case	Much improved; still in hospital.
78	Dec. 29, 1902	Jose R., 32 years, male, white.	Dec. 29 Jan. 13 Feb. 15		15 26 40	51	34	14	1	Usual symptoms; extreme case	Now improving rapidly; still in hospital.
79	Nov. 14, 1902	Juan M, 60 years, male, mulatto.	Jan. 13		39					Moderate case; blood not again examined	Cured.
80	Jan. 13, 1903	Juan R., 23 years, male, mulatto.	do		33					Moderate case	Improving; still in hospital.
81	do	Pedro Q, 18 years, male, mulatto.	do Feb. 15		42 68	54	17	19	10	Usual symptoms; very much stunted mentally and physically; looked to be about 10 years of age; genitals infantile type.	Cured.

[1] White cells.

Second group—Continued.

No. of case.	Date.	Name, age, sex, and color.	Date of blood examinations.	Red cells per cubic millimeter.	Hemoglobin, per cent.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Eosinophiles.	Symptoms and points bearing on case.	Remarks.
82	Jan. 13, 1903	Primitivo R., 20 years, male, mulatto.	Jan. 13		20					Usual symptoms save edema	Improving in hospital.
			Feb. 15		33	68	17	4.5	10.5		
			Mar. 12		45						
83	.....do.....	Julio C., 18 years, male, white.	Jan. 13		28					Usual symptoms; same remark for this case as in case 81.	Cured.
			Feb. 15		51	59	19	8	14		
			Mar. 12		75						
84	Jan. 4, 1903	Pedro R., 21 years, male, white.	Jan. 13		25	80.5	10	4	5.5	Usual symptoms; but very severe attack	Improving; still in hospital.
			Feb. 15		40	76	9	6	9		
85	Jan. 17, 1903	Jose M., 20 years, male, white.	Jan. 17	1,450,000	12	89	5.5	3.5	2	Very bad case; has tuberculosis	Died.
			Feb. 15	[1] 4,700	21	50	18	26	6		
86	Jan. 26, 1903	Gervasio M., 12 years, male, white.	Jan. 26		30	67	16	7	10	Usual symptoms; extreme pallor	Cured.
			Feb. 15		64	63	16	6	15		
87	Feb. 15, 1903	Juan B	Feb. 14		10	34.5	44.5	17	4	An extreme case; usual symptoms	Slowly improving in hospital.
			Mar. 12		16						
88	.....do.....	Abelardo O., male	Feb. 15		32	47.5	30	12	10.5	Usual symptoms	Improving in hospital.
			Mar. 12		35						
89	Jan. 26, 1903	Vicente R., 19 years, male, mulatto.	Jan. 26		68	47.5	29.5	9	14	Usual symptoms; probably tuberculous pleuritis; eventually empyema, for which he was operated upon.	Unchanged in hospital.
			Feb. 15		54	69	14	8	9		
90	Jan. 31, 1903	Paulino V	Jan. 31		32	56	12	12	20	Usual symptoms; acute case	Improving in hospital.
91	Feb. 15, 1903	Segundo L	Feb. 15		50	80	9	4	7	Usual symptoms	Do.
92	.....do.....	Eduardo B., 30 years, male, white.	...do.....		38	69.6	21.5	6.4	2.5	....do	Do.
			Feb. 25		42						
			Mar. 12		50						
93	Dec. 30, 1902	Maria T., 22 years, female.	...do.....		75	53	22	13	12	.....do	Do.
94	Jan. 12, 1903	Maria C., 27 years, female, white.	Jan. 12		25					Usual symptoms; intense pallor; No emaciation.	Great improvement, although hemoglobin still low; still in hospital.
			Mar. 8		32						
95	Mar. 8, 1902	Juana T., 20 years, female, white.	...do.....		10	70	17	3	10	Very extreme case; in seventh month of pregnancy; had miscarriage later.	Improving rapidly in hospital.
96	Mar. 1, 1902	Antonio C								Usual symptoms; no blood record	Improving.

97	July 15, 1902	Delgado, 19 years, male, white.	.....	.....	.....	.....	.....	.....	.....	Very severe case; no blood record	This is one of the most successful cases we have had; a perfect condition of health has been secured and he is working in the hospital.
98	July 10, 1901	L. G., 21 years, male, white; soldier, Philippines about a year ago; arrived in Manila October, 1899; went immediately out on outpost duty in the mud; says about 20 of his company became pallid and had dyspnea so that they had to fall out on the march in the campaign following; he first noticed his pallor in June, 1900.	July 10	5,400,000 [1] 8,200	82	36.5	42	4	17.5	Pasty color marked; lips light lilac color at edges; dyspnea on violent exertion; vertigo; blurred sight at times; colored images before eyes; somnolent; apathetic with typical facies; paresthesia of arms and feet, tinnitus aurium, pains in legs, patellar tendon reflex normal; much headache and slight loss of weight; pulsation of vessels in supraclavicular and intraclavicular spaces marked; bruit-de-diable in right jugular; enlarged spleen; much palpitation of heart at one time; has had fever of low grade and when disease began had epigastric pain; gives history of having been covered with slimy mud of rice patties and of eating with muddy hands during his campaign; a decidedly impure first sound is found on auscultation of the heart.	This patient was entirely cured at Fort Slocum, N. Y., before our cases previously cited in these histories were begun.
			Aug. 4	.....	95	.....	.....	.....	.....		
99	Aug. —, 1902	Carmen, 22.....	.....	.....	.....	.....	.....	.....	.....	Usual symptoms with great pallor; the record of the blood count was lost, but the hemoglobin is remembered to have been low; this patient is from a good family and is accustomed to excellent food; her father was a coffee planter and she was accustomed to bathe in a stream that runs through the estate; has had eruptions on the legs.	
100	June —, 1903	Juan Martinez, 14 years, white.	1902. June 12	[1] 7,600	45	55	23	11	11	Usual symptoms.....	Under treatment.

[1] White cells.

THE UTUADO SERIES OF 1904.

These case histories were published in the report of the Porto Rico Anemia Commission of 1904, and as they are very complete and well portray the clinical picture of two, at least, of the three types, the moderate and the marked, they are included herein.

All of these patients were kept in the field hospital, within a few steps of the dispensary, and we were in constant contact with them:

Age:	
Below 10 years of age	5
Between 10 and 14, inclusive	18
Between 15 and 19, inclusive	9
Between 20 and 29, inclusive	13
Between 30 and 39, inclusive	13
Between 40 and 60, inclusive	3
	61
Sex:	
Males	44
Females	17
	61
Color:	
White	46
Mulatto	15
Négro	0
	61

The chief value of the blood records is that they are taken at regular intervals of a week, at the same time of day and at a time before the administration of the specific drug which prevented the influence of the same upon the blood.

The abbreviation "Hb." signifies hemoglobin; "E," eosinophiles; "P," polymorphonuclear neutrophiles; "S. L.," small lymphocytes; "L. L.," large lymphocytes; "B," basophiles; "S. C.," Türck's stimulation cells; "My," myelocytes. Although not expressed in all cases, Charcot-Leyden crystals were never absent from the feces. The coagulation of the blood was almost always very slow, and the number of degenerated leucocytes was great in practically every case; especially was this true of eosinophiles. The number of leucocytes counted for the differentials was usually 250, but at times reached 500.

These histories had to be condensed into the smallest possible space. For this reason and in order to have a connected account, no separation of objective and subjective signs has been attempted. Hemic murmurs refer to the heart. Although anatomically the abdomen embraces the epigastrium, we have used the former to refer to the lower abdomen and mention the two separately from the great difference in their clinical significance in this disease.

Such abbreviations as, "2-15," "4-40," etc., signify 2 or 4 grams of thymol and 15 or 40 grams of sodium sulphate before and after taking thymol. In other words, the number preceding the hyphen is the dose of thymol, the number following it the dose of sodium sulphate.

Case 1.—J. S., town of Utuado. Admitted, May 8, 1904. Age, 23; male; white; married. Laborer on coffee estates. States that he has no work on account of illness. Sister died of anemia. Eats usual food of country people. Has severe mazamorra every year at time of rains. Has had much iron and quinine. Well marked pallor; lips very cyanotic; is well developed and well nourished. No edema; pruritus of

feet; no atrophy of skin but same is dry and harsh; does not perspire. Little appetite; gastralgia; nausea; no vomiting; flatulence; decided tenderness abdomen and epigastrium; meteorism; bowels normal; enteralgia; feces, normal color and consistence, but says that he has seen blood in his stools; many eggs of uncinaria, ascaris, and trichocephalus. Spleen normal; liver extends to 1 inch below ribs. Suffers greatly from dyspnea, palpitations, and pain in region of heart. Pulse 110, strong and full. Heart not enlarged; slight hemic murmur best heard at third left intercostal space. Slight pulsation veins of neck and decided of arteries in neck and supraclavicular regions. Much pain in chest. Much dizziness and tinnitus aurium. Constant frontal and cerebellar headache, Sleepless and cast down. Suffers from fainting spells. Patellar reflex diminished. Intelligence excellent. Complete impotence for from 15 to 20 months. Susceptible to cold. Paresthesia lower limbs decided. Urine, sp. gr. 1.017; reaction, acid; color, amber; nothing abnormal. Tendency to dilatation of pupil; blurred vision. Muscles flabby, sore, and painful. Decided general weakness. Often has slight fever.

Course of case.—Uneventful, save that in early part of July he was taken with severe pain in abdomen, which precipitated an attack of hysteria mayor with all the signs of sudden and severe congestion of the brain. He lay in a trance-like condition for about three hours, but recovered completely. For a similar case see case 30. No albumen found in urine.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 8	33	2,968,000	13,200	16.8	44.8	29.6	8.4	0.4	.....	.....
16	36	2,991,040	5,000	22.4	46.4	14.8	15.2	1.2	.....	.....
23	38	3,960,000	5,200	16.4	58.3	9.0	16.3	.....	.....	.....
30	36	4,384,000	3,200	17.6	37.6	14.0	16.0	.8	14.0	.....
June 6	50	4,000,000	9,200	8.6	55.0	15.6	6.8	.4	13.6	.....
13	56	4,541,600	5,200	14.8	47.6	22.4	12.0	.8	1.6	0.8
20	62	4,360,000	9,800	10.8	64.4	14.4	10.0	.4	.....	.....
27	67	5,261,600	7,200	8.8	58.4	22.4	10.4	.....	.....	.....
July 4	66	4,152,800	8,800	9.0	42.7	36.0	11.4	.3	.6	.....
11	76	6,866,400	6,400	6.0	35.6	29.2	27.2	1.2	.8	.....
18	83	7,635,200	6,200	.....	.....	.....	.....	.....	.....	.....
25	83	7,035,200	7,400	4.8	58.8	17.2	17.6	1.2	.4	.....
Aug. 1	82	5,176,000	4,000	5.6	52.0	24.8	17.2	.4	.....	.....
8	75	5,924,000	5,000	8.4	44.0	31.2	15.2	.8	.4	.....
15	101	5,164,000	7,800	8.8	41.2	37.6	12.0	.4	.....	.....

Remarks.—May 8, blood very fluid; coagulation much delayed. Slight poikilocytosis. June 27, many bacilli in blood. Reds seemingly normal. August 1, reds normal; some bacilli.

Treatment.—May 9, 4–40; 16th, ova uncin.; 17th, 4–40; 24th, ova uncin.; 25th, 4–30; June 2, no ova uncin.; 19th, ova uncin.; 20th, 4–30; 29th, a few ova uncin., some ova tricocephalus and many Charcot-Leyden crystals. One tyroglyphus longior; July 1, 4–20, preceded by 0.03 podophyllin; August 8, no ova uncin.; 15th, no ova uncin.; 22d, no ova uncin; 25th, ova uncin.; 26th, vomits sod. sulphate so was given effervescent citrate of magnesia before and after thymol 6; August 1, no ova uncin.; 8th, no ova uncin. but many ova of schistosoma mansonii; 15th, no ova uncin.

Result.—Cured August 15. Is now a powerful ruddy man without a trace of his former disease. A little mucus in stools which are loaded with schistosoma eggs. Shortly after this entered the insular police force.

Case 2.—J. R., barrio Salto Abajo. Admitted as out patient, May 9. Age, 24; male; white; single; laborer in garden and on coffee estates; weight, 135. Seven of his family are suffering from anemia; father died of it. Has been ill 12 years. Food mainly vegetable; rarely eats meat. Has had much mazamorra. Lately has consumed 2 quarts of an iron tonic, and many patent iron pills. He is very pale but still has a little color left in the conjunctivae. Not emaciated and general development is excellent. A little edema of face and extremities. Ulcer of right leg. Slight atrophy of skin, which is very dry. Rarely perspires. Appetite good; no gastralgia, nausea, or vomiting. Tongue looks as if a pen had been wiped on it; i. e., two purplish lines on dorsum. Flatulence; no tenderness abdomen or epigastrium; bowels regular; feces chocolate color, formed, no blood or mucus, many ova of uncinaria and ascaris, and meat fibers. Spleen and liver normal. No dyspnea; palpitations; no pain over heart; pulse 80, dicrotic and compressible. Heart not enlarged. Soft blowing murmur, best heard at third left intercostal space. No pulsation veins. Dizziness; tinnitus aurium; frontal and temporal headache. No sleeplessness; decidedly hypochondriacal. No fainting fits. Patellar reflex almost abolished. Very typical facies. Intelligence good. No impotence. No susceptibility to cold. Has paresthesias feet.

Urine normal, sp. gr. 1.012. Pupils tend to dilate. Blurred vision. Muscles soft, sore, and painful. Much weakness and breathlessness on exertion. Subject to slight fever.

Course of case.—Rapid improvement in all symptoms. Never had any food from hospital and, at every visit to clinic, complained of poor food at home.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 9	38	3,968,800	6,000	13.6	62.0	18.0	4.8	1.6	.....	.....
16	38	4,093,280	10,200	18.8	63.2	13.6	3.2	1.2	.....	.....
23	37	5,400,000	3,600	18.0	66.0	9.6	3.6	2.0	0.8	.....
30	50	5,217,600	18,400	23.5	60.0	9.5	4.0	1.0	1.5	0.5
June 6	59	6,000,000	10,800	12.4	64.0	8.4	6.0	.8	8.4	.....
13	66	6,632,000	9,400	11.2	65.6	12.4	7.2	1.2	2.4	.....
20	90	6,301,600	9,200	10.4	72.0	10.0	5.6	1.6	.4	.....
27	100	6,484,400	22,600	6.8	75.6	9.6	6.8	1.2	.....	.....
Aug. 5	113	.....	.....	.....	.....	.....	.....	.....	.....	.....

Remarks.—May 9, blood very fluid and coagulates slowly. Poikilocytosis and polychromatophilia marked. Many microcytes; a few macrocytes. May 23, reds more normal; 48 normoblasts per cmm. June 6, 43.2 megaloblasts per cmm. June 20, reds normal.

Treatment.—Blaud's pills used in intervals between days thymol administered. May 9, 4–30; 16th, very few ova uncin., no ova ascaris, 4–40; 23d, still a few ova uncin., much better, 4–30; 30th, still ova uncin., 4–30; a most remarkable improvement in this case; June 6, many more ova uncin., 4–30; is taking on flesh and feels well; 13th, 4–30, still a few ova uncin.; 20th, no ova uncin.; 29th, no ova uncin.

Result.—Cured, June 27. All signs of disease have disappeared and the man is fat, ruddy, and working.

Case 3.—M. G., barrio Rio Abajo. Admitted May 9. Age, 16; male; mulatto; single; has no occupation because of his illness; usually works on coffee estates; weight, 95 pounds. Five in family suffer from anemia (we had ocular proof of this as his improvement brought the whole family down as patients); three of family died of anemia. Food, mainly vegetable, with codfish, beans, and rice at times. Has suffered much from mazamorra. Has taken much iron. Marked pallor of m. m. and cyanosis of lips. Color of skin gray. Decided emaciation. Is poorly developed. Has had general edema but does not present it now. Has had ulcers in legs. Slight atrophy of skin which is very dry and harsh. Does not perspire. Has large appetite but "vomits all" he eats. Much gastralgia and nausea; flatulence; tenderness, epigastrium and abdomen; meteorism; constipated; enteralgia; feces, dark yellowish brown, much undigested food, meat and vegetable fibers, many Charcot-Leyden crystals, a great many ova of uncinaria, a few of ascaris and tricocephalus. Spleen and liver normal. Dyspnea; palpitation and pain over heart; pulse 80, very weak and compressible. Badly formed chest. No heart murmur. Much pain in chest. Dizziness; roaring in ears keeps him awake at night; frontal and temporal headache; neuralgic pain in head; sleepless. Is very miserable and cast down. Intelligence very limited. Says he is always "frozen" from cold. Paresthesia, legs and feet. Pupils tend to dilate; vision blurred. Muscles flabby, painful, and sore. He is exceedingly weak. Has had fever.

Course.—A very marked case of dilated stomach; a ravenous appetite but persistent vomiting. Boy continued, in spite of this, to improve daily. Is an earth eater.

Diagnosis.—Chronic uncinariasis; intense.

Complication.—Dilatation of stomach.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 9	25	2,640,000	7,400	9.8	70.7	11.5	7.5	0.5	.....	.....
16	29	2,560,000	7,000	8.0	71.2	15.6	4.4	.8	.....	.....
23	31	3,040,000	7,200	10.4	64.0	13.6	7.6	.....	4.4	.....
30	35	3,208,000	6,400	18.8	64.8	7.6	4.0	1.6	3.2	.....
June 7	41	3,844,000	6,200	23.2	56.4	7.2	9.2	.8	2.8	0.4
13	46	4,074,400	6,600	15.6	63.2	16.4	4.0	.....	.8	.....
20	59	3,666,400	6,000	9.2	66.8	11.2	10.0	2.0	.8	.....
27	59	4,292,800	3,600	16.0	56.4	21.2	3.6	.8	2.0	.....
July 4	84	4,110,400	8,200	16.0	57.6	16.8	8.0	.8	.8	.....
11	100	4,582,400	6,000	17.2	56.0	18.4	7.6	.....	.4	.4
18	103	5,048,800	6,800	13.2	51.6	20.8	11.6	1.6	.....	1.2

Remarks.—May 9, blood very fluid and coagulates slowly. Slight polychromatophilia and poikilocytosis, many microcytes. June 27, macrocytosis prevails. Many degenerated leucocytes. Neutrophilic granules stain poorly in many cells. Little poikilocytosis or polychromatophilia. July 4, reds apparently normal. 18th, reds normal. One eosinophilic myelocyte.

Treatment.—May 9, 4–45; 16th, ova uncin.; 17th, 4–40; 23d, 4–30; 30th, ova uncin.; 31st, 4–25; June 9, ova uncin.; 10th, 4–20; 20th, ova uncin.; 21st, 4–20; 27th, no ova uncin; July 2, nitro-muriatic acid, gtt V. t. i. d. for dyspepsia; 6th, few ova uncin.; 7th, 4–20; 12th, no ova uncin.; 23d, discharged.

Result.—Cured, July 18. All signs of uncinariasis disappeared. Still suffering from dilatation of stomach but not to any great extent. Color good and is strong and active.

Case 4.—G. V., barrio Caguana. Admitted, May 10; age, 35; male; white; single; laborer on coffee estates. Food: Rice, beans, codfish, and vegetables. Gives clear history of mazamorra preceding anemia, and he, himself, connects the two. Has had a great variety of iron tonics. Moderate pallor; no emaciation. No edema; general pruritus; atrophy of skin marked; ever since disease began has failed to perspire. Good appetite; no gastralgia; has nausea and vomiting; flatulence; no tenderness of epigastrium or abdomen; no meteorism; constipated; no enteralgia; feces black, streaked with yellow, meat and vegetable fibers, no blood or mucus, few ova uncinaria and many Charcot-Leyden crystals. Spleen and liver, normal. Dyspnea; palpitation; no pain in precordium; pulse, 72, strong and full; no heart murmur; no pain in chest. Dizziness; tinnitus aurium; little headache; sleepless; hypochrondriacal; has fainting spells; intelligence, good; impotence (a prominent symptom); reflexes normal; susceptible to cold; paresthesias of legs and feet. Urine normal, sp. gr. 1.008. No tendency to dilatation of the pupil but blurred vision. Muscles flabby, but no soreness nor pain. Decided weakness.

Course.—An uneventful course but a very obstinate case as will be seen from the blood chart.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 10	28	2,656,000	9,000	19.6	51.2	21.6	6.8	0.8	.....	.....
17	39	3,604,000	7,600	16.8	62.4	11.2	8.8	.8	.....	.....
24	40	4,040,000	8,400	18.0	60.4	12.0	4.8	.8	4.0	.....
30	44	4,475,520	9,200	25.6	54.8	9.6	7.2	.....	2.4	0.4
June 7	41	5,066,400	7,200	7.2	60.8	10.8	6.0	1.0	14.2	.....
14	44	4,776,000	8,400	15.6	50.0	26.8	7.6	.....	.....	.....
21	54	4,555,200	9,200	19.6	52.8	20.8	6.0	.4	.4	.....
28	73	4,808,800	4,400	13.2	58.4	22.0	5.2	.8	.4	.....
July 5	57	4,888,000	7,800	14.4	48.4	28.4	8.4	.4	.....	.....
12	57	5,532,800	7,000	15.2	56.0	14.4	14.4	.....	.....	.....
19	82	6,720,000	8,200	8.8	68.4	10.4	11.6	.8	.....	.....
26	84	6,035,200	7,600	16.8	61.2	11.2	9.2	1.6	.....	.....
Aug. 2	90	5,400,000	5,800	20.0	53.6	18.0	7.6	.8	.....	.....
9	86	5,715,200	4,200	16.0	59.2	17.6	6.8	.4	.....	.....
14	100	6,435,200	10,200	24.8	54.4	14.0	6.8	.....	.....	.....

Remarks.—May 10, blood very fluid, a tendency which it sustained almost to the last, with slow coagulation; poikilocytosis; polychromatophilia; many macrocytes and microcytes. July 19, reds still tend toward macrocytosis but to a less degree.

Treatment.—May 11, 4–30; 17th, no ova uncin.; 18th, no ova uncin., two specimens examined; 20th, no ova uncin.; 26th, one ovum uncin.; 27th, 4–30; June 2, ova uncin.; 3d, 3–25; 11th, no ova uncin.; 15th, 3–25; 21st, no ova uncin.; 28th, no ova uncin.; July 5, no ova uncin.; 12th, no ova uncin.; 26th, one ovum uncin.; 27th, 4–15, preceded by 0.03 podophyllin; August 3, no ova uncin.

Result.—Cured, August 3. Rosy color. Every sign of disease has disappeared.

Case 5.—M. M., barrio Salto Arriba. Admitted, June 24; age, 14; female; mulatto; single; country girl; aids in coffee picking. Anemia is the one disease of her family. Food, mainly vegetable. Has had mazamorra. Moderate pasty pallor. Is fat and well developed save that she has not yet menstruated. Edema of face, trunk, and lower extremities; general pruritus; no atrophy of skin but great dryness; never perspires. Good appetite; gastralgia; nausea; no vomiting; tongue dark color; flatulence; tenderness epigastrium and abdomen; meteorism; ascites; bowels normal; enteralgia; feces normal save for large number of ova of uncinaria. Spleen and liver enlarged. Dyspnea, palpitation, "pain in heart;" pulse, 72, weak and compressible; heart, hemic murmur. Pain in chest. Dizziness; tinnitus aurium; headache, frontal and temporal; sleep normal; mental condition, very peculiar; a curious half melancholic,

half sullen expression of face; intelligence, poor; no fainting spells; patellar reflex diminished. Muscles flabby and painful. Debility. Temperature, 37.1.

Course.—A very rapid improvement noted, above all in her mental condition. She completely changed her character, becoming pleasant and interested in her surroundings.

Diagnosis.—Acute uncinariasis, moderate, rapidly becoming severe.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 26	45	4,432,000	7,600	9.6	53.2	28.0	8.0	1.2	.....	.....
July 3	47	4,381,600	11,000	13.2	60.8	19.6	6.0	.4	.....	.....
10	65	4,901,600	10,000	13.6	51.6	25.2	9.6	.....	.....	.....
17	70	5,506,400	6,200	12.8	46.8	27.2	12.4	.8	.....	.....
24	90	5,835,200	9,400	20.0	40.8	33.2	4.8	.8	0.4	.....
31	105	4,999,600	9,200	18.0	58.4	13.2	10.0	.4	.....	.....

Remarks.—June 26, blood fluid and coagulability diminished. Poikilocytosis and slight polychromatophilia. Microcytes predominate over macrocytes. Many bacilli. July 3, few bacilli. July 10, more bacilli than ever. 17th, no bacilli, reds normal.

Treatment.—Blaud's pills used in the intervals. June 27, 3-20, preceded by 0.03 of podophyllin; July 5, one ovum uncin.; 6th, 3-15, preceded by 0.03 podophyllin; 10th, few ova uncin. and many Charcot-Leyden crystals; 11th, same as on 6th; 17th, no ova uncin. but some larvæ of strongyloides intestinalis; 28th, ova uncin.; 29th, 4-10, preceded by 0.03 podophyllin; 31st, no ova uncin.; August 2, no ova uncin. Discharged.

Result.—A wonderfully rapid cure. Has gained much in weight and has a fine color.

Case 6.—R. G., barrio Caniaco. Admitted, May 11. Age, 22; white; single; laborer in coffee plantations and banana patches. Says he has never lost weight but rather has gained. Brother of case 3. Has been sick for years. Customary country food, but now codfish is hard to get as whole family are too sick to work. Says that every time he had three or four cents he purchased "iron powders." Is very pallid with only a little color left in lips and gums. Not emaciated. Has had very marked edema of legs; much mazamorra; general pruritus; has had ulcer of left leg; skin dry and harsh; never perspires; no atrophy of skin. Appetite good; much gastralgia, nausea, and vomiting; flatulence; tenderness of abdomen and especially of epigastrium; meteorism; slight ascites; bowels, regular; enteralgia; feces, dark but normal save for eggs of uncinaria and ascaris. Spleen and liver normal. Breathlessness on walking; marked palpitation of heart with pain in precordium; pulse, 85, weak and compressible; heart apparently normal. Marked supraclavicular pulsation. Pain in chest. Dizziness; tinnitus aurium; sleeps "continually." Has fainting spells. Is melancholy and dispirited, with a hopeless, staring expression. Low order of intelligence. Patellar reflexes extinguished. Completely impotent; susceptible to cold, and has paresthesias of legs. Pupils tend to dilate; has obscured vision and night blindness. Muscles flabby, sore, and painful. Very pronounced weakness.

Course.—This was as stubborn a case as we have had. His resistance to the toxin seemed fair, for he became active, and said he felt well, but our belief is that he still has a good number of uncin., perhaps not expelled on account of protection afforded by folds of the m. m. and mucus. He expelled, all together, a tremendous number of parasites.

Diagnosis.—Chronic uncinariasis; intense.

Complication.—Tertian intermittent malarial fever.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 11	22	2,288,000	9,000	20.4	61.2	14.0	4.0	0.4	.....	.....
18	22	2,160,000	7,800	12.8	62.0	17.6	7.2	.4	.....	.....
25	22	2,096,000	3,800	18.8	62.0	9.2	8.0	.8	1.2	.....
June 1	30	2,768,000	5,200	12.8	60.4	8.8	11.2	.8	4.4	1.6
9	45	3,181,000	8,400	14.0	65.2	6.0	10.0	.....	3.6	1.2
16	37	4,337,000	8,600	18.0	54.0	18.8	8.0	.....	.4	.8
23	45	3,880,000	7,000	11.3	65.4	15.6	7.0	.4	.....	.3
30	48	3,928,000	7,600	20.7	63.0	10.6	5.4	.3	.....	.....
July 7	57	3,964,000	6,800	17.2	56.0	15.6	10.8	.4	.....	.....
14	42	4,864,000	5,000	13.6	45.6	26.4	13.2	1.2	.....	.....
21	63	4,840,000	7,400	13.1	60.8	16.1	8.4	.8	.8	.....
28	66	5,020,100	9,600	16.0	70.0	10.8	2.8	.4	.....	.....
Aug. 4	62	3,804,000	9,400	18.5	56.7	15.5	8.5	.8	.....	.....
11	68	4,475,200	7,600	21.2	58.8	12.0	8.0	.....	.....	.....
19	70	4,728,800	8,600	16.0	52.0	22.4	9.2	.4	.....	.....

Remarks.—May 11, blood very fluid, coagulates slowly. High grade of polychromatophilia; poikilocytosis extreme. Macrocytes very numerous. Fewer microcytes; 24.2 normoblasts per cmm. A second differential count was made, and a difference of but one eosinophile and one polymorphonuclear was noted. These specimens were taken separately. June 1, 20.8 megaloblasts per cmm.; one eosinophilic myelocyte; July 7, one eosinophilic myelocyte; 14th, poikilocytosis, polychromatophilia, and macrocytosis marked. One eosinophilic myelocyte; July 28, blood more nearly normal.

Treatment.—May 12, 4-40; 18th, still enormous number of ova of uncinaria, and a few ova of tricocephalus. Huge number of Charcot-Leyden crystals; 19th, 4-30; 26th, many ova uncin.; 27th, 4-30; June 2, still ova uncin.; 3d, 4-30; 8th, ova uncin.; 10th, 4-30; 17th, ova uncin.; 18th, 4-30; 23d, no ova uncin.; 30th, no ova uncin.; ova tricocephalus; many Charcot-Leyden crystals; July 7th, ova uncin.; 8th, 4-15, preceded by 0.03 podophyllin; 11th, typical malarial paroxysm; 0.324 quinine every 4 hours for 5 days; 14th, no ova uncin.; 21st, no ova uncin.; 28th, no ova uncin.; August 5, calomel 0.13, podophyllin 0.01 followed by extract filix mas 8. This caused expulsion of a few worms; 11th, no ova uncin.; 19th, no ova uncin.

Result.—Practically cured, August 19. Symptoms have disappeared.

Case 7.—R. G. B., barrio Caguana. Admitted, May 14. Age, 9; white; male; four brothers died of anemia; has been ill two years; has usual country food with codfish and sometimes meat; clear history, given by father, of mazamorra preceding anemia; since illness began, much iron and cod liver oil given him with no result. Extreme pallor, giving him a dirty yellow color. Edema of face and lower extremities. Good appetite but gastralgia and nausea follows; flatulence; abdomen tender; typical "pot belly;" decided ascites; feces, dark brown, contain abundance of ova of uncinaria, a few ova of ascaris, and Charcot-Leyden crystals. Spleen and liver normal. No dyspnea; palpitation and precordial pain; pulse, 80, weak and compressible; marked hemic murmur. Marked pulsation of jugulars and other vessels in neck. Pain in chest. Dizziness, tinnitus aurium, frontal headache; sleeps well; expression sad and dispirited; patellar reflex abolished; urine, normal, sp. gr. 1010. Pupils tend to dilate, and vision obscured. Muscles flabby, and is very weak.

Course.—Uneventful. Child gradually became playful, eyes brightened up, and color returned.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 14	10	2,266,640	7,000	18.4	40.3	34.0	6.3	1.0	.....	.....
21	23	1,648,880	6,600	30.0	54.8	10.6	2.8	.8	1.0	.....
28	26	2,381,000	10,000	24.4	44.8	23.6	2.0	3.2	2.0	.....
June 4	25	5,000,000	8,400	20.8	38.4	17.2	13.2	1.6	8.4	0.4
12	42	4,532,000	11,000	18.8	46.4	12.0	10.0	4.4	8.4	.....
18	45	4,426,000	18,000	13.6	54.4	20.4	8.0	1.2	2.4	.....
25	68	4,224,000	6,200	13.2	50.0	30.8	4.0	.4	1.6	.....
July 2	64	5,075,300	9,000	10.8	73.2	10.0	4.4	1.2	.4	.....
9	76	6,755,300	15,000	16.0	56.8	15.2	10.0	1.6	.4	.....
15	103	6,008,000	16,400	21.2	54.8	15.6	4.8	2.0	.4	1.2

Remarks.—May 14, blood very fluid, coagulates slowly. Much poikilocytosis and polychromatophilia. Reds are small with pale centers. Polymorphonuclears have very large granules. August 9, reds apparently normal. July 15, one eosinophilic myelocyte.

Treatment.—May 15, 2-20; 22d, ova uncin.; 23d, 1-15; 28th, ova uncin.; 29th, 2-15; June 7, many ova uncin.; 8th, 2-15; 13th, no ova uncin. (two specimens); 18th, ova uncin.; 19th, 2-15; 25th, no ova uncin.; discharged hospital July 3. This child was sent home to make room for others. His father warned us that he would have poor food at home. On the 15th he had 103 per cent, the hemoglobin having registered 64 per cent on the day he was discharged from hospital.

Result.—Cured, July 15. He is the picture of a healthy boy, with excellent color.

Case 8.—V. B., Utuado, formerly Guaonico. Admitted May 11. Age, 40; male; white; married. Laborer on coffee and banana plantations. Had a small farm of his own until he became too sick to work it. Sold it for a small sum and moved to town to obtain treatment for his sickness. Habits, good. Two brothers sick with anemia. Three died from same cause. States that he has had "calenturas," meaning attacks of slight fever. Had mazamorra. Symptoms began about two years ago.

Until became too sick to work had plenty to eat, including meat. Has taken treatment at city hospital, which gave temporary improvement. Pallor quite marked; no emaciation; well developed; slight edema of face and trunk. No atrophy of skin, but dryness. No perspiration. Good appetite; gastralgia; nausea, but no vomiting. Tongue slightly coated. Tenderness over epigastrium and abdomen, flatulence, and ascites. Bowels regular. Feces contain slight amount of mucus and great many ova of uncinaria. Dyspnea on exertion, palpitation, and "pain in heart." Pulse 90, fairly strong. Heart not enlarged. Slight purring murmur over apex with second sound. Slight bronchitis, some cough, and pain in chest. Dizziness, tinnitus aurium, frontal headache, wakefulness, syncope at times. Mental condition dull and torpid, always lamenting over his poverty and sickness. Patellar tendon reflexes abolished; intelligence fair; impotent; increased susceptibility to heat and cold, and paresthesias. Urine, sp. gr., 1.015, normal. Right eye more dilated than left; blurred vision. Muscles flabby, weak, and sore. Temperature normal.

Course.—Constant and steady improvement. Became animated, energetic, and much more intelligent. Proudly boasted that he was now able to support his family and no longer begged.

Was in hospital only 8 days; afterwards outpatient.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 11	34	2,392,800	9,200	4.0	74.4	17.2	2.8	1.6	.....	.....
20	37	3,456,000	8,800	23¼	53½	8¼	14¼	¾	.....	.....
27	40	3,648,000	7,800	12.4	62.0	6.8	11.6	1.6	4.8	.8
June 3	55	4,790,400	7,200	8.0	69.2	6.4	13.6	.8	2.0	.....
10	45	4,424,000	5,800	11.6	72.8	4.4	8.8	1.6	.4	.....
17	47	5,048,800	8,200	13.6	61.2	8.0	13.2	1.6	1.6	.....
24	56	6,724,000	13,600	3.6	76.4	4.4	12.0	2.0	1.6	.....
July 1	56	6,124,200	5,400	9.2	65.6	10.8	12.4	2.0	.....	.....
8	58	5,057,600	10,000	6.8	67.2	10.4	13.2	2.4	.....	.....
15	59	4,728,800	6,200	8.4	58.8	15.6	13.6	2.4	1.2	.....
22	60	4,955,200	5,200	8.4	66.0	11.6	12.0	2.0	.....	.....
29	75	5,939,600	9,000	16.8	55.6	17.2	7.2	2.8	.4	.....
Aug. 5	69	5,257,600	5,800	16.0	55.2	12.4	15.6	.8	.....	.....
12	73	6,270,400	5,800	10.4	72.4	7.2	7.6	2.0	.....	.4
19	78	5,786,400	5,600	7.6	72.0	6.8	12.4	1.2	.....	.....

Remarks.—May 11, blood looks normal macroscopically. Poikilocytosis and polychromatophilia. Some macrocytes and many microcytes. June 10, appearance of blood much improved; 1 eosinophilic myelocyte; 17th, 32.8 normoblasts per cu. mm., 2 eosinophilic myelocytes. July 1, 21.6 normoblasts per cu. mm.; 15th, appearance of blood improving; 22d, blood much improved. August 5, blood looks normal; 19th, large basophilic lymphocyte noted.

Treatment.—Blaud's pills after July 23 in intervals. May 11, 4-40; 20th, 4-30; 28th, few ova uncin., 4-30. June 3, few ova uncin., 4-30; 10th, no ova uncin., 4-30; 17th, no ova uncin.; 24th, no ova uncin. July 1, no ova uncin.; 15th, no ova uncin.; 22d, very few ova uncin., 4-15, preceded by 0.03 podophyllin; 29th, very few ova uncin., 4-15, preceded by 0.03 podophyllin. August 5, very few ova uncin., 4-15, preceded by 0.03 podophyllin; 12th, no ova uncin., 4-15, preceded by 0.03 podophyllin; 19th, brought no specimen of feces.

Result.—Practically cured. Symptoms, including heart murmur, have disappeared. Has good color. Feels well and is working.

Case 9.—P. M. M., barrio Rio Abajo. Admitted May 12. Age, 11; male; white. All of family have anemia; father and two brothers died of it. Has been four years sick. Usual food of country. Has had mazamorra. Has taken iron tonics. Marked pallor. Not emaciated. Edema of lower extremities. General pruritus. Skin dry. Good appetite; gastralgia; no nausea or vomiting; flatulence; tenderness abdomen; meteorism; feces normal, save for many ova of uncinaria, Charcot-Leyden crystals, and ova of trichocephalus and ascaris. Spleen and liver normal. Dyspnea; palpitation; precordial pain; pulse 102 and weak. Marked systolic hemic murmur and pulsation vessels of neck. No cough nor pain in chest. Much dizziness and tinnitus aurium; frontal headache; sleep normal. Patellar reflex abolished. Is dispirited and lifeless. Susceptible to cold. Urine, sp. gr., 1.012, normal. Blurred vision. Muscles flabby, painful. Much weakness. Temperature 38°.

Course.—Gradual betterment.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 12	20	2,600,000	6,200	27.6	47.2	13.2	10.4	1.6	.....	.....
19	30	2,520,000	5,800	22.4	44.0	20.0	11.2	2.4	.....	.....
26	40	3,288,000	6,000	17.6	42.0	25.6	7.6	1.6	5.6	.....
June 2	41	4,096,000	6,100	13.6	50.8	14.8	7.6	.4	11.2	1.6
9	41	4,764,000	4,200	8.8	53.2	20.0	9.6	.8	6.8	.8
16	54	4,896,000	4,200	25.2	42.0	21.2	5.6	2.4	3.6	.....
23	57	4,496,000	6,800	43.6	20.8	18.8	8.8	1.2	6.8	.....
30	58	5,372,800	7,000	37.2	38.4	15.2	4.8	.4	4.0	.....
July 7	62	4,376,000	7,400	35.6	36.0	19.2	2.4	.....	6.8	.....
14	68	4,680,000	10,800	34.4	41.6	18.8	1.2	1.6	2.4	.....
21	68	5,216,000	9,600	29.2	42.4	21.6	2.4	.8	3.6	.....
28	87	5,128,000	9,400	26.8	42.4	24.4	4.8	1.2	.4	.....
Aug. 4	87	5,344,000	10,800	42.4	27.2	20.0	4.0	2.0	4.4	.....
11	90	4,936,000	9,600	34.8	46.4	12.4	4.8	.....	1.6	.....
18	103	5,048,000	9,800	28.4	52.4	14.6	4.6	.....	.....	.....

Remarks.—May 12, blood very fluid and coagulates slowly. Poikilocytosis and polychromatophilia. Macrocytes and microcytes. August 18, reds steadily improved to normal.

Treatment.—May 14, 2–15; 19th, ova uncin.; 20th, 2–15; 26th, ova uncin.; 27th, 2–15; June 9, ova uncin.; 10th, 3–20; 16th, many ova uncin.; 17th, 3–20; 23d, no ova uncin.; 30th, no ova uncin.; July 8, no ova uncin.; many Charcot-Leyden crystals; 14th, no ova uncin.; 21st, no ova uncin.; 28th, no ova uncin.; August 4, no ova uncin.; 11th, no ova uncin.; 15th, discharged from hospital.

Result.—Cured, August 18. Is perfectly well and has good color.

Case 10.—P. R., barrio Vivi Abajo. Admitted, May 12. Age, 20; male; white; unmarried; occupation, bread vendor, but was herding cattle when he was taken sick. Habits, good. One brother died of anemia. Ate good food until taken sick; meat formerly, not now. Had mazamorra since disease began, but does not remember previous attacks, as he was too young. Extremely pale, probably most marked pallor of any case. Is very thin, but states that such is his normal condition. Has been pale and sick ever since he can remember. Has taken wines and iron in various forms with only temporary relief. Has never had edema. Has small ulcer on left leg and one on same foot between toes. No atrophy skin, but it is very dry. Appetite, good; gastralgia, at times; no nausea, and rarely vomiting; tongue slightly coated. No flatulence, pain, or tenderness in abdomen. Feces contain a great many ova of uncinaria. Dyspnea; palpitation; no pain about heart. Pulse, 96, weak, dicrotic, compressible. Heart not enlarged; no murmur; marked pulsation in neck and supraclavicular regions. No cough, nor pain in chest. Sleeps fairly well. Mental condition is good. Intelligence good. Expression staring owing to prominence of eyes. Reflexes diminished. Susceptibility to heat and cold increased; paresthesias not marked. Urine, sp. gr. 1,014; normal. No eye symptoms. Muscles weak but not painful or sore. A very striking case, in which one would expect more symptoms.

Course.—Very rapid improvement at first, then slow but steady.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 12	20	3,195,520	6,400	0.8	58.8	17.6	20.8	2.0	Not counted.	
19	28	2,804,000	5,000	4.8	50.8	25.6	16.8	2.0	Not counted.	
26	38	4,075,520	3,400	6.8	56.0	14.8	18.0	1.2	3.2	.....
June 2	38	4,626,400	3,800	4.8	62.4	7.6	20.0	2.0	2.8	0.4
9	41	5,901,600	4,400	4.0	53.2	17.2	18.0	3.6	4.0	.....
16	46	5,817,600	4,400	7.2	55.2	12.4	15.6	4.0	4.4	1.2
23	49	6,016,000	5,000	8.0	64.4	10.8	13.2	2.4	1.2	.....
30	55	5,964,000	6,400	21.2	57.2	12.4	9.2	.....	.....	.....
July 7	67	6,436,400	7,600	12.8	58.0	19.2	9.2	.8	.....	.....
14	76	6,295,200	11,200	9.2	68.8	12.4	8.8	.....	.8	.....
21	82	6,017,600	6,600	9.6	54.4	20.4	14.4	.4	.8	.....
28	83	6,384,000	4,400	8.0	68.0	9.6	14.4	.....	.....	.....
Aug. 4	90	6,630,400	8,800	3.2	68.4	14.8	12.8	.....	.....	.8
11	104	6,724,000	7,800	1.6	69.6	16.0	12.4	.4	.....	.....

Remarks.—Extreme poikilocytosis and polychromatophilia. Very few macrocytes, many microcytes, 102.4 normoblasts to cu. mm.; 19th, enormous number and size of macrocytes. Microcytes more abundant. Hardly a normal sized cell. Much poikilocytosis and polychromatophilia. Twenty megaloblasts and 60 normoblasts per cu. mm.; 26th, many degenerated leucocytes; 40.8 normoblasts to cu. mm.; June 2, one eosinophilic myelocyte; June 9, appearance of blood improving; 16th, still improving. Two eosinophilic myelocytes; 30th, appearance of blood very good, little poikilocytosis and polychromatophilia. Few macrocytes and microcytes; August 14, blood much improved; 28th, reds looks normal.

Treatment.—May 13, 4–40; 19th, many ova uncin.; 28th, 4–30; 26th, many ova uncin.; 27th, 4–25; June 1, less ova uncin.; 2d, 4–25; 8th, still ova uncin.; 10th, 4–25; 17th, some ova uncin.; 18th, 4–20; 23d, no ova uncin.; 30th, no ova uncin.; few Charcot-Leyden crystals: July 28, no ova uncin.; August 5, 7, 4–15, preceded by 0.03 podophyllin. Stools searched for uncinariæ, but none found.

Result.—Cured. As markedly rosy as he was formerly pale.

Case 11.—J. M. M., barrio Roncador. Admitted May 12. Age, 37; male; white; widower; laborer on coffee estates; sick five years. Food: Meat, rice, beans, and vegetables; has had mazamorra; has taken much iron. Pallor very marked; no emaciation; edema of whole body; pruritus; little appetite; gastralgia; flatulence; no nausea nor vomiting; tenderness epigastrium and abdomen; meteorism; feces dark, soft, contain mucus, Charcot-Leyden crystals, and many ova of uncinaria. Dyspnea; palpitation; pain in heart. Pulse, 76, weak and compressible; heart dilated, murmurs marked. Marked pulsation vessels of neck. Pain in chest. Dizziness; tinnitus aurium; frontal headache; patellar reflex abolished; expression sad and hopeless; intelligence good. No impotence; suffers from cold. Urine, sp. gr. 1,015, normal. Pupil tends to dilate readily; vision blurred. Muscles flabby. Great weakness.

Course.—One of the most susceptible to the toxin we have seen. A very rebellious case. We have reason to believe, from the large number of parasites expelled in the last month, that the few ova in the stools gave little idea of the number of uncinariæ still within.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 12	32	2,656,000	6,800	22.0	55.6	16.0	6.0	0.4	.....	.....
19	22	2,344,000	5,400	16.4	59.2	17.6	6.8	.....	.....	.....
26	27	2,364,000	6,000	11.6	68.0	17.2	2.0	.....	1.2	.....
June 2	26	2,915,000	11,000	11.2	68.4	6.8	10.0	.8	2.4	0.4
9	31	3,052,800	11,200	14.0	53.2	11.6	13.2	1.6	6.4	.....
16	34	3,000,000	7,600	8.4	72.0	14.0	3.6	.4	1.6	.....
21	38	4,026,400	9,400	7.6	79.0	7.0	6.0	.4	.....	.....
30	36	3,504,000	6,800	9.4	75.3	9.7	5.6	.....	.....	.....
July 7	48	3,804,000	11,000	6.4	64.8	16.4	12.0	.4	.....	.....
14	52	4,496,000	11,200	7.2	72.4	8.8	9.2	2.0	.4	.....
24	66	3,670,400	9,200	5.6	58.8	14.0	20.8	.4	.4	.....
31	60	4,816,000	8,800	6.4	63.2	17.2	12.8	.4	.....	.....
Aug. 7	60	5,600,000	7,400	8.8	59.6	22.0	9.2	.4	.....	.....
14	80	6,400,000	8,800	13.6	60.0	12.0	12.4	2.0	.....	.....

Remarks.—May 12, blood very fluid and coagulates slowly, poikilocytosis and polychromatophilia, macrocytes and microcytes abundant; 19th, same as before to extreme grade; 21.6 megaloblasts and 86.4 normoblasts per cmm.; 26th, less poikilocytosis, microcytes predominate; 24 megaloblasts and 24 normoblasts per cmm.; June 9, 89.6 megaloblasts, 268.8 normoblasts per cmm.; 16th, 30.4 normoblasts per cmm.

Treatment.—May 13, 4–40; 19th, ova uncin.; 20th, 4–25; 25th, ova uncin.; 26th, 4–25. June 1, ova uncin.; 2d, 4–25; 9th, ova uncin.; 10th, 4–30; 30th, ova uncin.; 4–20, with podophyllin 0.03. July 7, no ova uncin., but many Charcot-Leyden crystals; 14th, ova uncin.; 15th, 4–20 with 0.03 podophyllin. He was discharged from hospital June 22 with Hb. 38 per cent and reached 80 per cent at home.

Result.—Practically cured August 14. A very different man from what he was May 12.

Case 12.—I. R., barrio Viví. Admitted May 13. Age, 55; female; white; widow; has been a coffee picker; her brother is being treated at our dispensary. Many of family died of anemia. Very poor food. Mazamorra of feet and hands, contracted by washing clothes on bank of a stream. Very extreme pallor; decided emaciation;

edema of legs, extreme; petechiæ arms, and legs purpuric in places; some one has attempted to reduce swelling on legs by two enormous blisters which cause her great pain. Decided atrophy of skin, with deep furrows in face; skin dry and harsh. Does not perspire. Good appetite, no gastralgia; nausea and vomiting; flatulence; tenderness of abdomen and especially of epigastrium; meteorism; ascites; very constipated; enteralgia. Feces contain many ova of uncinaria. Spleen and liver normal. Dyspnea; palpitation; pain in region of heart. Pulse, 120. Very weak and compressible. Decided heart murmur. Marked pulsation vessels of neck. Constant racking cough and pain in chest. Much expectoration containing tremendous number bacilli tuberculosis. Dizziness; tinnitus aurium; severe headache and neuralgic pains; sleeplessness. The facial expression of this woman is beyond description. Very hypochondriacal, completely hopeless, and very querulous. Paresthesia of feet. Muscles flabby, sore, and painful. Has evening rise of temperature.

Was brought in a hammock and is in the last stages of uncinariasis and tuberculosis, with cavities in both lungs. Her death was momentarily expected.

Course.—Improvement slowly took place as time went on. She was so desperately ill that we had to seize upon any favorable day to administer thymol, which she always stood well, feeling better thereafter.

Diagnosis.—Chronic uncinariasis; intense.

Complication.—Advanced pulmonary tuberculosis.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 13	27	2,306,640	6,200	2.0	90.0	6.4	1.6	.....	.....	.....
20	19	1,688,000	5,000	.4	78.4	14.0	6.4	0.8	.....	.....
27	25	1,804,000	3,800	4.1	70.5	15.9	5.0	1.0	3.5	.....
June 7	27	2,964,000	4,800	.....	86.8	4.0	3.6	.....	5.2	0.4
July 31	30	2,977,600	8,600	.8	78.8	8.8	9.6	.4	1.6	.....

Remarks.—May 13, blood very fluid and coagulates very slowly, marked poikilocytosis and polychromatophilia, macrocytes and microcytes abundant, reds give perfect picture of pernicious anemia save absence of megaloblasts; 20th, 20 normoblasts per cmm.; same remarks for reds.

Treatment.—May 13 and 14, strychnia and digitalis hypodermically; 15th, 2–25; 16th, felt better, stimulation hypodermically every 4 hours; 17th, hard chill and high fever, signs of tubercular pneumonia; 21st, creosote in 200 c. c. of water in increasing doses; 27th, many ova uncin., condition very bad; 28th, 4–20, hypo. injections stopped and tinct. digitalis and nux vomica used. June 8, better. Asked to go home and was sent. July 8, returned in hammock much improved but still very sick. Same treatment for tuberculosis and debility. July 15, many ova of uncin.; 20th, 4–15, with 0.03 podophyllin. Discharged July 31.

Result.—Decidedly improved of uncinariasis and in her general condition. Her legs are no longer edematous.

Case 13.—F. M., barrio Caguana. Admitted May 13. Age, 30; female; white; married, has borne 7 children; washerwoman, coffee picker, and works on farm. Husband under treatment for uncinariasis. Later her child also. Has had two stillbirths. Says she has always been anemic. Usual food of country, but has little to eat since husband has been ill. Has had mazamorra every coffee crop. Very extreme pallor. Skin like yellow parchment. No emaciation. Edema of lower extremities marked. Previously had general edema to extent that eyes were closed. Decided atrophy of skin. Perspires little. Appetite capricious; gastralgia; nausea; no vomiting; flatulence; tenderness of abdomen and epigastrium marked; meteorism; ascites; very constipated; enteralgia; feces, light reddish brown, with a little blood, undigested food, and Charcot-Leyden crystals; fair number ova of uncinaria. Spleen and liver normal. Dyspnea; palpitation; much precordial pain; pulse, 112, very weak and compressible. Dilated heart, with loud murmurs. Tremendous pulsations in neck and base of neck; on right side a distinct thrill; *bruit-de-diable* in jugulars. Much cough (from hypostatic edema of lungs); pain in chest. Dizziness; much tinnitus aurium; little headache; neuralgic pains; roaring in ears prevents sleep. She is a neurasthenic of the worst sort, with a worn, excited, dissatisfied expression. Subject to fainting spells and hysterical attacks; patellar reflex abolished. Has not menstruated since having her first baby. Suffers from cold. Has had three abortions. Decided paresthesias in hands and feet. No disturbances of vision. Muscles flabby,

sore, and painful. So weak that she sank on the steps of the office, unable to move. Was brought in on horse. Is just out of puerperium, child died the first day.

Course.—May 20, she is decidedly better and walks without much assistance. From this on she slowly improved.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 13	14	1,226,400	4,200	8.4	66.4	18.0	6.0	0.8	.....	0.4
20	21	1,746,640	5,000	4.4	72.8	17.2	5.2	.4	.....	.....
27	21	2,084,400	5,600	2.8	65.2	17.6	9.2	.8	3.6	.8
June 3	22	2,504,000	4,000	3.2	64.8	13.2	14.8	.4	3.6	.....
10	22	2,377,000	3,600	2.4	78.4	5.2	8.8	1.2	3.6	.4
17	32	2,555,000	2,800	3.2	63.2	22.0	9.2	.4	1.2	.8
24	52	4,461,000	4,200	3.2	54.4	22.0	19.2	1.2	.....	.....
July 1	41	3,528,800	4,200	2.8	61.6	19.6	15.2	.8	.....	.....
8	65	4,870,400	8,200	1.2	73.6	11.6	10.8	2.4	.4	.....
15	78	4,852,800	4,200	5.6	52.8	26.4	14.8	.4	.....	.....
22	78	4,352,000	5,600	3.2	61.2	17.2	17.6	.4	.4	.....
29	68	4,417,000	6,200	3.2	67.2	12.0	16.4	.8	.4	.....
Aug. 7	95	5,092,800	8,200	4.8	68.0	18.0	8.0	1.2	.....	.....
14	109	5,190,400	10,800	2.0	56.0	24.4	16.8	.8	.....	.....

Remarks.—May 13, blood like beef washings. Coagulation very slow; very extreme poikilocytosis; polychromatophilia; macrocytes and microcytes abundant; 33.6 normoblasts per cmm.; 20th, reds about same. Granules of polymorphonuclears large; June 17, 11.2 megaloblasts and 11.2 normoblasts per cmm.; July 1, much poikilocytosis, microcytes predominate; July 15, decided tendency to degeneration of leucocytes; polymorphonuclears still present large granules; 22d, reds nearly normal.

Treatment.—May 14, 3–30; 20th, still few ova uncin.; 21st, 4–25; 27th, still fair number ova uncin.; 28th, 4–20; June 8, no ova uncin. (2 specimens); 10th, no ova uncin.; 13th, no ova uncin.; 17th, no ova uncin.; 24th, no ova uncin.; July 1, no ova uncin.; 8th, 15th, 29th, and 30th, no ova uncin. Discharged from hospital, 68 per cent Hb. August 7, no ova uncin. but given 4–15 with 0.03 podophyllin. Expelled some parasites and Hb. rose to 109 per cent on 14th.

Result.—Cured, August 14. The change in this woman is remarkable. She has good color and is fat and well.

Case 14.—F. V., barrio Don Alonso. Admitted, May 14. Age, 14; white; no occupation; "when my father was rich, I always wore shoes, but since the cyclone I have been out in the mud barefooted." Father in insane asylum for some years; mother dead. Has been ill since the cyclone (August 8, 1899). Food poor; often hungry. Pallor began after sharp attack of mazamorra. Has been taking patented iron pills. Very extreme pallor; not emaciated. General development good. General edema marked; extreme in lower extremities. Ulcers on legs in the past. Atrophy of skin. Does not perspire. Good appetite; gastralgia at times; vomits at times; flatulence; tenderness of abdomen and epigastrium; no meteorism nor ascites; bowels regular; enteralgia; feces dark brown; no blood or mucus; loaded with uncinaria ova; a few of ascaris. Spleen and liver normal. Dyspnea; palpitation; pulse 130, weak and compressible. Slight hemic murmur; heart not dilated. Pulsation of vessels in neck marked. Cough; little pain in chest. Much dizziness and tinnitus aurium. Temporal headache; sleeps poorly; a completely downcast and hopeless expression; is a well-educated boy of decent parents; has fainting spells; suffers from cold and has paresthesias of legs and arms; blurred vision; muscles flabby, sore, and painful. Great debility. Temperature 39.8°.

Course.—Had a little fever every day for awhile, but soon began to improve, and recovery was uneventful. He followed the commission to San Juan on foot. This is one of the saddest cases we saw, one in which poor food, hard knocks, and abandonment broke down what must originally have been a strong resistance.

About the time the blood specimens showed bacilli he had marked edema of left leg and foot. Right leg not edematous.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 14	16	1,551,200	7,800	18.3	50.0	21.0	9.2	1.5	.....	.....
21	31	2,133,280	6,200	14.4	51.6	20.0	12.0	2.0	.....	.....
28	27	2,666,400	11,600	18.4	40.0	26.8	10.4	1.2	3.2	.....
June 4	30	3,880,000	9,800	28.4	24.4	27.2	9.6	1.2	8.8	0.4
11	35	3,315,200	7,400	22.0	50.0	11.2	11.2	.4	5.2	.....
18	50	4,181,400	14,800	17.2	43.6	25.2	10.0	.8	2.4	.8
25	59	5,238,400	11,200	46.0	26.0	19.6	7.6	.8	.....	.....
July 2	56	5,288,800	7,400	22.0	44.4	20.0	12.0	1.2	.4	.....
9	55	5,195,200	11,200	32.4	21.6	30.4	14.0	1.2	.4	.....
17	64	5,461,000	8,600	40.0	29.2	19.6	10.8	.4	.....	.....
23	64	5,786,400	4,800	18.0	46.0	24.8	10.8	.4	.....	.....
30	84	5,440,000	9,600	24.4	34.8	22.8	16.4	1.2	.4	.....
Aug. 6	90	6,688,000	6,800	26.0	31.6	32.8	8.4	.8	.4	.....
14	101	5,928,800	10,200	28.4	30.4	31.6	6.8	.8	2.0	.....

Remarks.—May 14, blood like beef washings; high grade of poikilocytosis and polychromatophilia; decided macrocytosis; 62.4 normoblasts per cmm.; 21st, poikilocytosis and polychromatophilia still severe; June 4, 38.2 megaloblasts per cmm.; July 9, many bacilli; August 6, no bacilli, reds normal.

Treatment.—May 15, 3–25; 22d, ova uncin.; 23d, 3–20; 28th, ova uncin.; 29th, 4–20; June 9, ova uncin.; 10th, 4–20; 18th, still a few ova uncin.; 19th, 4–20; 25th, no ova uncin.; July 3, 9, 17, and 23, no ova uncin.; 26th, discharged from hospital with 64 per cent Hb. August 6, no ova uncin., but many Charcot-Leyden crystals and 1 ovum of tricocephalus; 7th, calomel 0.13, podophyllin 0.01 at night, and 4 extract filix mas next day. Expelled no parasites (at least it was so reported), but Hb. rose to 101 per cent August 14.

Result.—Entirely cured. Boy is rosy and perfectly well. In 1910 this boy, now a young man of excellent physique, applied for enlistment in the army and was accepted without a flaw.

Case 15.—L. B., barrio Salto Arriba. Admitted May 14. Age, 37; male; mulatto; married, three children; laborer on coffee plantations; has been ill since cyclone of 1899; usual food of country; has had much mazamorra; extreme pallor of mucous membranes, and dull, dirty gray color of skin; not emaciated; general edema; ulcers on legs; atrophy of skin; does not perspire; appetite good; gastralgia; no nausea or vomiting; tongue has many dark pigmented spots; flatulence; tenderness of abdomen and epigastrium; meteorism; has had ascites; feces, diarrheal with mucus, a few Charcot-Leyden crystals, and an abundance of ova of uncinaria. Spleen, normal; liver, enlarged. Dyspnea; palpitation; precordial pain; pulse, 100, dicrotic and compressible. Heart murmur almost organic in character. Very pronounced pulsation of vessels at base of neck. Cough, and pain in chest. Much dizziness and tinnitus aurium; cerebellar and temporal headache; decided neuralgic pains. Sleeps good; is depressed, anxious, and hypochondriacal; subject to attacks of fainting; patellar reflex exaggerated; complete impotence; susceptible to cold; paresthesias in limbs. Urine, sp. gr. 1,008, normal. Blurred vision; muscles flabby, sore, and painful. Great debility.

Course.—Uneventful recovery. It is an interesting fact in this case that he was discharged from hospital the 25th of June with 68 per cent of Hb., and from this time on, although he complained bitterly of having only bananas to eat at home, he became a strong and perfectly healthy man on this diet, with a final Hb. of 110 per cent.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 14	11	1,608,800	19,200	20.8	48.0	19.2	8.0	4.0	.....	.....
21	20	2,168,880	6,200	18.8	49.2	15.6	10.4	2.0	4.0	.....
28	25	3,062,160	6,800	34.0	46.0	6.8	4.8	3.2	5.2	.....
June 4	33	3,897,600	6,000	21.6	46.8	20.4	11.2	.....	.....	.....
12	39	3,840,000	8,600	18.4	60.4	8.0	7.6	3.6	1.2	0.8
18	50	5,382,160	8,000	16.4	43.4	27.6	11.0	1.2	.....	.4
25	68	4,808,800	10,000	17.6	65.6	4.4	8.8	2.8	.....	.8
July 2	72	4,737,000	14,000	27.6	52.0	11.2	6.4	2.4	.4	.....
8	86	4,617,000	8,000	28.4	51.6	12.4	4.8	2.4	.4	.....
15	87	7,400,000	6,800	15.6	58.0	14.0	9.6	2.8	.....	.....
22	82	5,312,000	6,800	15.2	58.8	10.0	14.0	2.0	.....	.....
29	95	5,021,000	9,600	22.8	54.4	14.8	7.2	.4	.4	.....
Aug. 5	110	5,257,000	7,800	35.6	32.8	17.6	12.8	1.2	.....	.....

Remarks.—May 14, blood appears like beef washings; coagulates very slowly. Great poikilocytosis and polychromatophilia; 153.6 normoblasts per cmm. Many macrocytes and microcytes, former predominating. May 21 same except 24.8 normoblasts per cmm. June 4, one enormous macrocyte seen, 20 microns in diameter. July 2, character of reds has changed from a similarity to pernicious anemia to a good counterfeit of chlorosis. Slight poikilocytosis, no polychromatophilia, many microcytes. In general, size of reds less than normal. July 15, very large eosinophiles and many with granules scattered, no poikilocytosis nor polychromatophilia. Leucocytes all sizes, many degenerated. Eosinophiles same. Twenty-ninth, reds about normal, whites same as on last date. August 5, reds normal. Leucocytes not degenerated except a few eosinophiles but still show great variety in size. Many enormous eosinophiles. Many blood plates.

Treatment.—May 15, 4–40; 22d, ova uncin.; 23d, 4–25; June 2, no ova uncin.; 6th, 18th, and 25th, no ova uncin.; on June 25, discharged from hospital with Hb. 68 per cent. July 8, 15, 22, no ova uncin.; Hb. 82 per cent; 29th, and August 5, no ova uncin. Discharged August 5.

Result.—August 5, cured. A perfectly strong and healthy man, with excellent color.

Case 16.—J. M. R., barrio Sabana Grande. Admitted, May 13. Age, 27; female; white; married. Works on coffee plantations. Prevailing disease of family is anemia. Her grandfather and uncles died of it. Has been sick 12 years. Usual food of country. Has mazamorra every year at time of coffee picking. Has spent much money in iron tonics which have yielded no permanent result. Very marked pallor. No emaciation. Edema of face and lower extremities. General pruritus. Skin dry; does not perspire. No appetite; gastralgia; nausea; vomiting at times; flatulence; tenderness of abdomen; meteorism; enteralgia; feces, normal except for many ova of uncinaria, larvæ of strongyloides intestinalis, and Charcot-Leyden crystals. Spleen and liver normal. Much dyspnea; palpitation; sometimes precordial pain. Pulse, 88, weak; marked systolic cardiac murmur. Marked pulsation in vessels of neck. No cough nor pain in chest. Much dizziness, tinnitus aurium, and temporal headache; sleep normal. Subject to syncope. Patellar reflex abolished. Is sad and dispirited. Menstruation has stopped. Susceptible to cold. Has had one abortion. Urine, sp. gr. 1,013, normal. Blurred vision. Muscles flabby and painful. Very weak. Temperature, 38°.

Course.—Very slow due to difficulty in expulsion of uncinariæ.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 15	20	1,656,000	6,700	12.8	74.4	9.2	2.8	0.8	.....	.....
22	25	1,704,000	5,000	20.8	55.2	6.4	9.2	1.2	7.2	.....
29	26	2,630,400	5,000	21.4	62.2	9.2	3.2	.4	3.6	.....
June 5	31	2,640,000	5,200	16.8	58.8	14.4	5.6	.4	3.2	0.8
12	36	3,184,000	5,000	16.0	56.4	14.8	3.6	1.6	7.6	.....
19	50	3,008,000	7,400	13.6	56.8	18.8	6.0	1.6	3.2	.....
26	55	3,280,000	6,400	14.4	72.8	8.8	1.6	1.2	1.2	.....
July 3	42	4,048,000	5,400	14.0	54.0	30.0	.4	.....	1.6	.....
10	45	4,064,000	5,600	10.8	62.4	22.0	2.0	1.2	1.2	.4
17	51	4,168,000	5,200	10.0	66.4	16.0	2.8	3.2	1.6	.....
24	60	4,648,000	7,200	11.2	54.4	27.2	1.6	2.8	2.4	.4
31	64	4,088,000	7,800	13.2	61.2	12.8	12.0	.....	.....	.8
Aug. 7	64	4,784,000	10,200	3.6	68.4	18.4	2.0	.4	6.4	.8
14	90	5,320,000	7,400	3.2	74.4	13.2	6.0	.....	3.2	.....

Remarks.—May 15, blood very fluid and coagulates slowly. Poikilocytosis. Macrocytes and microcytes. August 14, reds have improved without incident and appear practically normal.

Treatment.—May 14, 2–30; 22d, ova uncin.; 23d, 3–20; 29th, ova uncin.; 30th, 3–20; June 9, no ova uncin.; 13th, no ova uncin.; 19th, no ova uncin.; 26th, no ova uncin.; July 3, no ova uncin.; 10th, no ova uncin.; 17th, no ova uncin.; 25th, no ova uncin.; 31st, no ova uncin. By this time we began to be sure that, in spite of showing no ova in the feces, this woman still harbored many uncinariæ, as her hemoglobin persistently refused to rise. Hence on August 8 there was administered 0.26 calomel and 0.02 podophyllin, and the next day 8 extract of male fern. This apparently brought away worms, for hemoglobin rose rapidly.

Result.—August 14, cured; a ruddy, healthy woman.

Case 17.—F. R., barrio Caniaco. Admitted, May 17. Age, probably 10 or 12; male; white; no occupation. Mother and some brothers died of anemia. He became sick about two years ago. Diet, vegetable, abundant. Has taken "iron powders" and home remedies. Not emaciated; very pallid; marked edema of face, trunk, and extremities. Has had mazamorra; general pruritus. Skin not atrophied, but dry. Appetite poor; sometimes gastralgia; no nausea; no vomiting; pain and tenderness in abdomen and epigastrium at times; flatulence; meteorism; ascites. Bowels fairly regular, sometimes diarrhea. Feces contain slight amount of mucus and enormous number of uncinaria ova. Also ova of ascaris lumbricoides and larvæ of strongyloides intestinalis. Dyspnea; marked palpitation and "pain in heart." Pulse, 120; weak and compressible. Heart slightly enlarged and dilated. Apex wavy, indefinite, and displaced downward and outward. Fremitus marked. Hemic murmur very loud and harsh. Pronounced pulsation of vessels in neck. Cough, and pain in chest. Dizziness; tinnitus aurium; general headache. Sleeps badly on account of cough. Reflexes abolished. Mental condition, very bad; intelligence, almost nil; face bloated and expression extremely despondent. Paresthesias. No eye symptoms. Muscles very flabby, painful, and sore. Extremely weak. Temperature, 38° C.

History given by man with whom he lived.

Course.—Ascites became extreme, requiring tapping of abdomen. Accompanied by severe watery diarrhea. After tapping he became emaciated, but improved in spirits and strength. Later edema reappeared, and tapping repeated, but he rapidly sank and died of exhaustion.

Diagnosis—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 17	9	1,062,160	9,200	1.6	76.4	12.4	8.8	0.8	.....	.....
24	11	1,176,000	20,600	.4	92.0	3.6	3.2	.....	0.8	.....
31	12	924,000	13,600	.....	96.4	.8	1.6	.....	.8	0.4
June 7	11	906,400	11,000	2.8	83.2	5.6	7.2	.8	.4	.....
14	14	1,044,000	11,200	2.8	68.0	12.4	13.2	.4	2.4	.8
21	15	1,524,000	19,400	.4	84.8	4 4	10.4	.....	.....	.....

Remarks.—May 17, when first examination was made, had general edema so that it was impossible to get blood without serous fluid. Other examinations were pure blood. Extreme poikilocytosis and polychromatophilia. Many macrocytes and microcytes; 147.2 normoblasts to cu. mm.; 31st, 217.6 normoblasts to cu. mm. More microcytes than macrocytes. About ⅓ of red cells are oval type of pernicious anemia. June 7, many bacilli, blood appears same, edema beginning again; 21st, same.

Treatment.—May 18, 2–20, followed by tr. digitalis and tr. nux vomica; 22d, ascites required tapping, 2 liters of fluid removed. Continued stimulation by adrenalin, digitalis, and nux vomica; 24th, extremely weak, severe diarrhea, Dover's powder; 28th, digitalis and nux vomica stopped, and fl. ext. kola given, appetite much improved; 31st, many ova uncin.; June 10th, edema and diarrhea beginning again. Diarrhea controlled by tanigeno; 15th, no diarrhea. Thymol, 1 gram without purge, produced no unpleasant effect; 17th, ascites tapped, removing 6 liters of fluid, stimulation renewed; 22d, thymol, 1 gram without purge; 25th, stimulation by hypodermic injection.

Result.—June 27, died of exhaustion.

Case 18.—G. B., barrio Viví Arriba. Admitted, May 14. Age, 45; male; mulatto; married; laborer on coffee plantation. Had been somewhat sick before last coffee season. Then had a bad attack of mazamorra, laying him up in bed 22 days. Failed rapidly since. Bedridden last four months. Ate usual food. Has taken some medicine, character unknown. Very pallid; emaciated. Edema of feet and ankles. Skin atrophied, dry, and harsh. Appetite good; no gastralgia; no nausea; no vomiting; tongue clean, but with black marking prominent; no flatulence; no pain in abdomen or stomach. Bowels constipated. Feces contain a great many ova of uncinaria. No dyspnea; palpitation; no pain about heart. Pulse 90, very weak and compressible. Heart enlarged and dilated; very loud murmur. No cough. Dizziness; tinnitus aurium; slight frontal headache. Sleeps well; mental condition dulled; intelligence good. Reflexes abolished; impotent; expression hypochondriacal; very peevish; increased susceptibility to heat and cold; paresthesias very marked. Neurasthenic. Blurred vision. Muscles very flabby, painful, and sore. Too weak to stand up. Temperature 38° C. Has fever every evening.

Course.—Fever continued about two weeks. Improved but little during the first few weeks, then improved rapidly in spirits and physical condition, but gained strength slowly. When discharged was beginning to walk.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 14	16	1,584,000	5,400	0.4	83.2	14.0	2.0	0.4	Not counted.	
21	17	2,324,000	3,000	2.4	62.8	22.8	10.4	1.2	0.4	.....
28	24	2,264,000	3,200	2.0	51.6	25.6	16.8	1.2	2.8	.....
June 4	23	2,200,000	2,400	2.0	57.0	18.0	18.0	.....	4.0	1.0
11	24	2,524,000	1,800	2.0	54.4	14.4	18.4	2.0	8.8	.....
18	30	3,221,600	3,400	1.6	65.2	18.0	13.6	.8	.8	.....
25	30	3,274,400	4,200	1.6	64.4	16.8	12.0	1.2	4.0	.....
July 2	29	2,992,800	5,200	4.4	59.2	16.4	19.2	.4	.4	.....
9	40	3,172,800	3,200	1.6	60.8	22.0	14.8	.8	.....	.....
16	51	3,392,000	7,600	2.0	64.0	18.8	14.0	.8	.....	.4
23	57	3,457,600	6,600	.8	60.0	21.6	16.4	1.2	.....	.....
30	70	4,204,000	9,600	5.2	62.8	17.6	14.4	.....	.....	.....
Aug. 6	67	4,360,000	8,600	5.6	63.2	16.4	12.4	2.0	.....	.4
13	80	5,492,800	9,000	6.8	68.0	8.4	16.4	.4	.....	.....
19	82	5,795,200	6,400	3.6	72.0	12.8	10.8	.8	.....	.....

Remarks.—May 14, extreme poikilocytosis and polychromatophilia, great many macrocytes and microcytes; 28th, more microcytes than macrocytes, macrocytes very large, 76.8 megaloblasts per cu. mm.; June 4, 9.6 normoblasts and 19.2 megaloblasts to cu. mm.; July 2, much less poikilocytosis and polychromatophilia, microcytes predominate over macrocytes; 16th, appearance of blood improving; August 13, slight poikilocytosis; polychromatophilia scarcely noticeable; 18 normoblasts per cu. mm.; 19th, blood almost normal.

Treatment.—May 18, 4–40; digitalis and nux vomica; 25th, 4–30; 29th, digitalis stopped; improving; June 1, ova uncin.; 4th, 4–25; 12th, ova uncin.; 13th, 4–25; 19th, ova uncin.; 4–25; 21st, given digitalis again; 26th, ova uncin.; 27th, 4–25; July 2, stopped digitalis; adrenalin given; some little edema of ankles; 3d, ova uncin.; 4th, 4–15, preceded by 0.03 podophyllin; 17th, no ova uncin.; 25th, few ova uncin.; 26th, 4–15, preceded by 0.03 podophyllin; 31st, no ova uncin.; August 7, few ova uncin.; 8th, 4–15, preceded by 0.03 podophyllin; 14th, no ova uncin.

Result.—Greatly improved. Still slight hemic murmur. No cardiac dilatation. Is beginning to walk. On several occasions this patient was expected to die.

Case 19.—J. C. S., barrio Arenas. Admitted May 17. Age 12; male; white; used to be a street vender of candies in Ponce; now works on a coffee plantation. Only disease in family is anemia; many died of it; "don't remember how many." In 1902 was cured of uncinariasis in Ponce. (One of the 100 Ponce cases, see p. 7.) Began again to show symptoms about three months ago—weariness, pain in chest, and a feeling as though "legs were dead" when he went to walk. Leaving Ponce in excellent condition, he came to Arenas and had a sharp attack of mazamorra at time of coffee picking. He positively assures us that his anemia came from this attack. Says he was ruddy and fat until his skin infection, which occurred in November, 1903. In February he began to notice symptoms of anemia. He is a very intelligent boy, and his former attack in Ponce has taught him what uncinariasis means. Decided pallor; lost weight, but general development is good; slight edema of eyelids. A large ulcer on leg, the remains of his mazamorra. General pruritus. No atrophy, but dryness of skin. Perspires. Good appetite; gastralgia; a little nausea, but no vomiting; flatulence; tenderness of epigastrium and abdomen generally; little meteorism. Bowels regular; no enteralgia. Feces normal, except for enormous number of ova of uncinaria. Spleen normal; liver slightly enlarged. Dyspnea, palpitation, and precordial pain. Pulse 120, weak and compressible. No heart murmur. (See transcript from previous attack.) No abnormal pulsation noticeable in neck. Slight cough and pain in chest. Dizziness; little tinnitus aurium; general headache; sleeps well; depressed and quiet; intelligence excellent, and character matter of fact and phlegmatic. Suffers slightly from cold. Paresthesias of arms and legs. Urine; Sp. gr. 1,015, normal. Blurred vision. Muscles flabby, sore, and painful. Is very weak. Has slight fever every night.

Course.—An uneventful and rapid recovery. The anemia was just beginning to reach a severe grade. He was not nearly so sick as during his previous attack, as can be seen by comparison with case 4 of series published in American Medicine, September 5 and 12, 1903; this is notable in that heart is free from murmurs, although anemia

is more profound. After his complete cure, July 4, 1904, he went home. Returning on the 29th, he presented a severe case of mazamorra of the feet. From this time on the boy became paler and his appearance was that of a person heavily affected. Feces and blood were examined frequently without finding ova of uncinaria or marked eosinophilia. (See blood record.) Further study of the case could not be made, as the boy left for parts unknown.

Diagnosis.—Acute uncinariasis; intense.

Transcript from notes on previous attack, 1902.—Six years ill; ulcers on feet; very pale; edema in legs at times; abundance of ova of uncinaria and Charcot-Leyden crystals; dull pain over heart; pulse 88 (dorsal decubitus), weak, small, and compressible; marked pulsations vessels of neck. Heart: Inspection; wavy impulse diffused over entire precordium. Palpation; forcible impulse just outside nipple line. Percussion; dullness extends from sternum to 1 inch beyond nipple, from 3d rib downward. Auscultation; loud, harsh murmur taking place of first sound, heard with greatest intensity over apex, and transmitted to sternum and axilla. Much dizziness, etc. Apathetic. Patellar reflex diminished. Urine; sp. g. 1,005, normal. Pains in legs, and extreme weakness.

Date.	Hb.	Reds.	Whites.
July 7, 1902	51	2,802,160	7,000
Aug. 22, 1902	74	4,806,400	3,000
Nov. 15, 1902	75	4,942,000	.....

Differential: E., 38 per cent; P., 42 per cent; S. L., 15 per cent; L. L., 5 per cent.

Treatment.—Vallet pills used in intervals. July 7, 2–30; 24th, 2–30.

Result.—Regained strength and color. Seen later in perfect health.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 17	28	3,480,000	7,400	10.0	53.2	27.2	8.4	1.2	.....	.....
24	29	3,024,000	7,200	8.0	71.2	6.0	10.8	1.6	2.4	.....
31	30	3,864,000	5,000	8.8	62.4	15.2	8.8	.4	3.6	0.8
June 7	50	3,981,600	11,600	4.0	64.4	8.4	12.0	2.0	9.2	.....
14	54	5,786,400	4,200	8.8	40.0	32.8	13.2	.....	5.2	.....
21	66	5,355,200	5,800	10.4	42.0	32.4	13.2	2.0	.....	.....
28	90	6,195,200	6,400	12.0	51.2	20.0	10.0	1.2	5.6	.....
July 4	103	7,088,000	17,800	6.4	[illegible]	16.8	10.0	.8	6.4	.....
21	115	.....	.....	.....	.....	.....	.....	.....	.....	.....
Aug. 2	95	.....	.....	7.2	60.8	14.4	16.0	.8	.8	.....
3	92	.....	.....	8.8	43.2	26.0	20.8	.8	.4	.....
4	92	.....	.....	6.4	41.6	21.6	29.2	1.2	.....	.....
6	85	.....	.....	6.0	39.2	21.2	32.8	.8	.....	.....

Remarks.—May 17, blood very fluid and coagulates slowly, poikilocytosis; polychromatophilia; many macrocytes; microcytes; 24th, 28.8 normoblasts per cmm.; 31st, 60 normoblasts per cmm.; July 4, reds normal. On the 1st of August, the reds were still normal. On the 4th, many Charcot-Leyden crystals in feces. On the 6th, same. Reds show beginning poikilocytosis.

Treatment.—May 18, 3–25; 26th, abundance of ova uncin.; 27th, 4–25; June 3, still ova uncin.; 4th, 4–25; 12th, still ova uncin.; 15th, 4–25; 21st, ova uncin.; 22d, 4–25; 28th, no ova uncin.; 4th, no ova uncin.; discharged.

Result.—Cured. The boy left hospital, July 4, with excellent color, and perfectly well. He returned on the 29th, having become reinfected.

Case 20.—R. P., barrio, Caonillas. Admitted, July 20. Age, 17; female; white; works at home, washing, taking care of animals, etc. Up to 2 years ago was strong, ruddy, agile, and always cheerful; at that time she went barefooted into her back yard and infected herself heavily with mazamorra. She remembers the day this occurred, and says that never before nor since had she had this dermatitis. In about one or two weeks from that time she began to have pain in the stomach. Later, followed weakness, fatigue on slight exertion, headache, profound mental depression, and slight pallor. The pallor and other symptoms increased, reaching a profound grade. Her food is of best quality and is abundant, as she is not poor. Has taken much iron, which made her feel temporarily better but afterwards worse than before.

Has an extreme dirty yellow pasty pallor; not emaciated; face a little edematous in the morning; general pruritus; no atrophy of skin. Has good appetite; no gastralgia; at times nausea; no vomiting. Bowels regular; no enteralgia; feces normal but for enormous number of uncinaria ova. No dyspnea; palpitation; no precordial pain. Pulse 112, normal strength and volume. Slight hemic murmur. Marked pulsation in vessels of neck. Has slight cough. Sputum examined but no tubercle bacilli found. Dizziness; tinnitus aurium; temporal headache; is always sleepy; is almost melancholic. Has fainting spells. Patellar reflex abolished. Menstruation scanty. Suffers from cold. Urine, specific gravity 1,012, normal. Blurred vision. Muscles flabby and painful. Great weakness. Temperature 38°.

Course.—Very rapid improvement.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
July 21	22	2,976,000	9,800	15.6	66.8	10.8	2.0	0.8	4.0	.....
Aug. 2	39	3,232,000	7,800	16.0	63.2	18.0	2.8	.....	.....	.....
9	62	4,832,000	6,000	10.0	65.2	18.8	4.0	1.2	.8	.....
16	70	5,284,000	9,600	6.0	68.0	23.2	2.4	.....	.4	.....

Remarks.—On entrance the reds showed some poikilocytosis and polychromatophilia, macrocytosis, and microcytosis, but not so much as would be expected with such low hemoglobin. Improvement was rapid until they appeared almost normal on August 9.

Treatment.—Blaud's pills used in intervals. July 26, 4–15, with 0.02 podophyllin; this dose caused much dizziness and debility but not at all alarming; 30th, heart murmur much diminished; August 2, very few ova uncin.; 3d, 3–15, with 0.01 podophyllin. No dizziness nor weakness on administration of drug; 9th, much improved, so much so that she appears entirely changed. Is cheerful and active. Few ova uncin.; 10th, same as 3d; 16th, ova uncin.; 3–15, with 0.02 podophyllin. Wonderful improvement; 19th, no ova uncin. Discharged.

Result.—Practically cured, August 19. We heard, on October 6, that she was "perfectly well, a very light-hearted girl with a fine color."

Case 21.—J. E. A., barrio Salto Arriba. Admitted, May 17. Age 13; male; white; coffee picker. Disease of the family is anemia; father and mother died of it. He has been sick four years. Usual food of country. Has had mazamorra. Has taken much iron, without betterment. Marked pallor, giving him a dirty pasty yellow color. Not emaciated. Edema of face and lower extremities. General pruritus. Skin atrophied; dry; does not perspire. Good appetite; gastralgia; no nausea or vomiting; flatulence; tenderness of abdomen; meteorism; enormous ascites. Bowels regular; at times enteralgia; feces normal save for ova of uncinaria, Charcot-Leyden crystals, and a few ova of ascaris. Spleen and liver normal. Dyspnea; palpitation; precordial pain; pulse, 123, weak. Heart enlarged; hemic murmur marked; marked pulsation vessels of the neck. No cough. Pain in chest. Much dizziness; constant tinnitus aurium; frontal headache; sleep normal; patellar reflex abolished. Is dispirited and lifeless. Suffers from cold. Urine, specific gravity, 1,014, normal. Tendency to dilatation of pupil. Muscles flabby, painful, and very weak.

Course.—Uneventful but slow. Had great difficulty in expelling last few parasites.

Diagnosis.—Chronic uncinariasis, very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 17	13	1,240,000	6,300	6.4	55.6	27.6	8.4	2.0	.....	.....
24	13	1,280,000	6,400	8.8	59.2	22.0	8.0	2.0	.....	.....
31	37	3,056,000	6,200	22.0	43.2	18.8	2.4	1.2	12.0	0.4
June 7	40	3,880,000	4,200	27.2	58.4	9.2	2.4	.....	2.8	.....
14	70	4,408,000	5,200	26.8	45.2	18.4	5.2	2.4	2.0	.....
21	77	4,512,000	6,400	13.6	55.2	18.4	6.8	2.0	4.0	.....
28	75	3,760,000	3,800	23.2	50.4	16.8	5.6	.8	3.2	.....
July 5	79	4,848,000	6,000	26.0	52.8	16.4	2.8	2.0	.....	.....
12	82	4,480,000	5,600	26.8	40.0	26.0	4.0	1.6	1.6	.....
19	89	4,928,000	6,800	28.0	56.8	7.6	5.6	.4	1.6	.....
26	102	5,040,000	6,400	14.8	66.0	17.6	1.2	.....	.4	.....

Remarks.—May 17, blood very fluid and coagulates slowly, poikilocytosis, polychromatophilia, macrocytes, and microcytes. Steadily improved to normal.

Treatment.—Blaud's pills used in intervals. May 19, 2-30; 24th, ova uncin.; 25th, 2-25; June 2, ova uncin.; 3d, 2-20; 10th, ova uncin.; 11th, 2-20; 21st, many ova uncin.; 22d, 3-20; 28th, ova uncin.; 29th, 3-20; July 5th, ova uncin.; 11th, ova uncin., many Charcot-Leyden crystals; 13th, 3-10, with 0.02 podophyllin; 19th, no ova uncin.; 26th, few ova uncin.; 27th, 3-10, with 0.03 podophyllin; August 2, no ova uncin. Discharged.

Result.—Cured, August 2. This boy is so completely changed as hardly to be recognizable by his friends. He is perfectly well, ruddy, and full of mischief.

Case 22.—P. G., Utuado. Admitted, May 18. Age, 9; female; white; works in a banana patch; has been ill one year; usual food of the country; she says that she was well until she contracted mazamorra; has taken "iron powders." Decided pallor, of pasty, dirty, yellow color; not emaciated. Edema of face and lower extremities; eyelids very puffy. Has had ulcers on her feet; no atrophy of skin; does not perspire. Good appetite; gastralgia; nausea; no vomiting; flatulence; meteorism; constipated; enteralgia; feces soft, dark, and contain many ova of uncinaria, some of ascaris, Charcot-Leyden crystals, and meat fibers. Spleen and liver normal. A little dyspnea; palpitation; pain in precordium; pulse 120, fairly strong and full. Heart hypertrophied; marked hemic murmur. Marked pulsation veins of neck. No cough. Much dizziness; tinnitus aurium; frontal headache. Sleeps well. Patellar reflex abolished. Has a despondent air. Intelligence good. Susceptible to cold. Urine; sp. gr. 1,014, normal. Blurred vision. Muscles flabby and painful. Temperature 37.8°.

Course.—Uneventful convalescence.

Diagnosis.—Chronic uncinariasis, very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 18	12	984,000	5,200	8.0	73.6	16.4	1.6	0.4	.....	.....
25	17	1,304,000	7,800	12.8	70.0	11.2	5.2	.8	.....	.....
June 1	35	2,264,000	6,200	10.0	60.0	17.6	2.8	2.0	7.6	.....
8	52	4,101,600	7,200	16.0	56.6	14.0	6.0	2.0	5.4	.....
15	72	4,536,000	5,200	8.8	44.0	26.8	8.4	.8	7.6	3.6
22	75	5,064,000	7,400	14.0	56.6	25.8	.8	1.2	1.6	.....
29	71	5,624,000	7,800	9.6	62.0	14.8	7.2	1.2	5.2	.....
July 6	75	5,600,000	7,600	12.0	58.0	22.0	2.0	1.2	4.8	.....
13	85	5,432,000	5,200	12.4	58.8	16.0	8.4	1.6	.....	.8
20	91	4,712,000	7,400	6.0	52.4	32.0	5.6	1.2	2.8	.....
27	104	4,840,000	4,200	7.2	61.6	26.4	3.2	1.2	.4	.....

Remarks.—Blood changes typical.

Treatment.—Blaud's pills used in the intervals. May 19, 2-20; 25th, ova uncin.; 26th, 2-15; June 3, no ova uncin.; 9th, a few ova uncin.; 10th, 2-15; 17th, attack of subacute enteritis. Given calomel 0.130 followed by tanigeno 0.324 t. i. d.; 20th, ova uncin.; 22d, 2-15; 30th, no ova uncin.; July 7, to 28, and August 6, no uncin.

Result.—Cured, July 27. A hearty, ruddy girl. This child has gained wonderfully in weight.

Case 23.—M. E., barrio, Sabana Grande. Admitted, May 18. Age, 30; female; white; married; works in fields as well as in house. Mother and several brothers and sisters anemic. Says she has been pale for a long time and very sick for five months. Vegetable food. Cannot remember if she had mazamorra. Extreme pallor; edema of face, trunk, and extremities; skin atrophied and dry; appetite, poor; gastralgia; nausea; vomiting; tongue slightly coated; flatulence; pain in epigastrium and abdomen; ascites marked. Bowels constipated. Feces contain great many ova of uncinaria. Dyspnea; palpitation; pain in heart. Pulse 115, weak, dicrotic, and compressible. Heart not enlarged; hemic murmur marked; strong pulsations of vessels in neck. "Heart cough;" pain in chest; dizziness; tinnitus aurium; headache; sleep fair; mental condition is bad, very despondent; intelligence poor; expression very sad; syncope frequent; susceptibility to heat and cold increased. Paresthesias very marked. Blurred vision. Muscular system flabby, painful, sore, and very weak, can scarcely walk. Amenorrhea. Temperature slightly elevated at night.

Course.—Uneventful and rapid improvement.

Diagnosis.—Chronic uncinariasis, very intense.

Date.	Hb	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C	My.
May 18	14	2,372,800	9,000	0.4	83.0	7.8	8.0	0.8	.....	.....
25	18	2,024,000	4,200	4.4	75.6	10.4	7.6	.....	2.0	.....
June 1	20	2,696,800	4,800	6.0	65.6	12.8	12.8	1.2	1.6	.....
8	44	4,520,000	21,000	3.2	81.6	4.0	7.6	1.6	1.6	0.4
15	51	4,832,000	5,400	4.8	75.2	10.0	8.0	.8	1.2	.....
22	60	6,244,000	4,200	4.4	65.6	15.2	12.0	.4	2.4	.....
29	65	5,417,600	7,800	5.6	73.6	14.8	6.0	.....	.....	.....
July 6	80	5,467,200	7,000	2.4	82.8	10.8	3.6	.4	.....	.....

Remarks.—May 18, great poikilocytosis and polychromatophilia. Many macrocytes, microcytes, and oval forms; June 8, 57.6 normoblasts per cu. mm. One basophilic lymphocyte. Polymorphonuclear leucocytosis causing relatively low percentages of other classes. 29th, some poikilocytosis and polychromatophilia. Few macrocytes and microcytes. July 6, no polychromatophilia nor poikilocytosis. Very few macrocytes and microcytes.

Treatment.—Blaud's pills used in intervals. May 18, tr. digitalis and tr. nux vomica; 20th, 4–30; 26th, few ova uncin.; June 8, ova uncin.; 4–25. Became outpatient; 15th, no ova uncin.; 22d, no ova uncin.; July 6, walked in from country without more than ordinary fatigue.

Result.—Practically cured. Has rosy color. Ceased to return.

Case 24.—V. R., barrio Tetuan. Admitted, May 18. Age 22; male; white; single; laborer on coffee plantations. Father died of "a pain," mother of anemia; eight months ago he had a good healthy color; good food before illness, now poor because of illness and inability to work. Has been ill since last coffee season, when he had severe attack of mazamorra. Has taken iron constantly since illness began, but to no effect. Very extreme pallor. Is well nourished. Has had edema of face, legs, and trunk. Ulcer on leg. No atrophy of skin, but does not perspire. Good appetite; gastralgia; nausea; and vomiting; flatulence; no tenderness abdomen; constipated; no enteralgia; feces normal but for many ova of uncinaria. Spleen and liver normal. Suffers much from dyspnea; palpitation; rarely has precordial pain. Pulse 150, weak and compressible. Heart enlarged, dilated; murmur seems organic in character. Pulsation of vessels of neck. Little cough; no pain in chest. A great deal of dizziness; tinnitus aurium; sometimes frontal and temporal headache; sleeps well; is downcast and apathetic; frequent syncope; patellar reflex abolished; very susceptible to cold. Has paresthesias of legs. Pupil tends to dilate; has blurred vision. Muscles flabby, sore, and painful. Great weakness. Temperature, 38°. Says he does not expect to get well.

Course.—A very slow convalescence. From 5th of June to 13th of July no ova of uncinaria. July 13, ova found, thymol given and Hb. rose.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 18	20	2,195,200	9,800	4.4	74.4	14.0	4.8	2.4	.....	.....
25	21	2,144,000	7,400	8.0	58.1	19.5	9.0	1.5	3.9	.....
June 1	20	1,572,000	7,400	8.0	53.2	12.0	14.0	.8	10.4	1.6
8	22	1,955,200	7,400	5.7	54.1	21.4	12.4	1.4	5.0	.....
15	22	2,332,800	6,200	5.2	51.6	30.0	12.0	.4	.8	.....
22	32	2,760,000	6,400	1.6	51.2	26.0	19.6	1.6	.....	.....
29	32	2,384,000	5,600	9.6	30.8	32.8	22.4	2.8	1.6	.....
July 6	34	2,435,200	8,000	10.4	55.6	20.8	12.4	.8	.....	.....
13	32	3,137,600	8,000	6.4	54.4	16.8	20.0	.8	1.6	.....
20	46	4,244,000	8,000	8.4	56.0	22.8	11.6	.4	.8	.....
27	60	4,496,000	8,800	13.2	49.2	21.2	16.4	.....	.....	.....
Aug. 3	75	4,417,600	9,400	16.0	52.4	17.6	12.8	1.2	.....	.....
10	70	4,635,200	10,000	12.8	49.2	22.8	14.0	1.2	.....	.....
16	75	5,088,000	7,600	9.2	46.4	27.2	16.4	.4	.4	.....
19	90	6,440,000	7,000	10.4	51.6	24.0	12.4	1.2	.4	.....

Remarks.—May 18, blood like beef washings. Coagulates slowly. Very marked poikilocytosis; slight polychromatophilia. 39.2 normoblasts per cmm. June 15, 74.4 normoblasts per cmm. 29th, great poikilocytosis, polychromatophilia. Microcytes very abundant and exceed macrocytes. July 6, reds same, 16 normoblasts per cmm. August 16, reds normal.

Treatment.—May 19, 4–40; 26th, many ova uncin.; 27th, 4–25; June 4, ova uncin.; 5th, 4–30; 11th, 16th, 22d, 29th, July 6, no ova uncin.; 13th, few ova uncin.; 14th, 4–15, preceded by 0.03 podophyllin; 20th, 28th, August 2d, 9th, 15th, and 18th, no ova uncin. Discharged from hospital.

Result.—Cured, August 18. Is perfectly well, strong, fat, and ruddy.

Case 25.—R. G., barrio, Paso Palmas. Admitted, May 19. Age, 19; female; white; single; coffee picker. Father and one brother died of anemia. Her first symptoms were great weariness and her body "went to sleep." Usual food of country. Has mazamorra every coffee season. Has taken much iron. Extreme pallor of a dirty, waxy color. Is emaciated. Edema of face and lower extremities. General pruritus. Has had ulcers on legs. Decided atrophy of skin. Does not perspire. Good appetite; gastralgia; no nausea or vomiting; no flatulence; tenderness of abdomen; meteorism; feces normal save for abundance of ova of uncinaria. Spleen and liver normal. Dyspnea; palpitation; precordial pain; pulse, 103, weak and compressible. Very pronounced hemic murmur. Marked pulsation in vessels of neck. Dizziness; tinnitus aurium; frontal and temporal headache; sleepless; has fainting spells. Patellar reflex abolished. Tactile sense normal. Is very much depressed. Has not menstruated for two or three years. Susceptible to cold. Paresthesias of feet. Blured vision. Muscles flabby, sore, and painful. Great debility. Temperature, 37.5°. This woman was brought in a hammock. From her waist down she was apparently paralyzed.

Course.—In one week she was walking; from this time on, her recovery was uneventful. Has pulmonary tuberculosis. A casual observer might have diagnosed this case "beriberi."

Diagnosis.—Chronic uncinariasis, intense.

Complication.—Pulmonary tuberculosis.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 19	22	1,946,640	3,200	6.8	67.2	14.0	10.8	1.2	.....	.....
26	27	2,452,800	6,000	2.8	68.8	18.0	6.0	.4	3.6	0.4
June 2	32	3,320,000	7,200	4.4	66.8	12.8	11.6	.4	4.0	.....
9	54	4,226,400	16,400	3.2	80.0	6.4	5.6	.8	4.0	.....
16	51	5,017,600	10,400	1.2	80.8	11.2	2.8	1.6	2.4	.....
23	76	4,591,040	9,400	2.4	75.6	11.6	9.2	.4	.8	.....
30	100	5,184,000	6,800	1.6	86.0	7.6	4.4	.4	.....	.....

Remarks.—May 19. Blood very thin and coagulates slowly. Extreme poikilocytosis and polychromatophilia; 25.6 megaloblasts and 12.8 normoblasts per cmm. Many macrocytes and microcytes; May 26th, still great poikilocytosis; 24 megaloblasts per cu. mm. Many macrocytes. June 2, appearance of blood improving; 28.8 megaloblasts per cu. mm. June 30, reds normal.

Treatment.—Blaud's pills used in the intervals. May 20, 4–40; 26th, few ova uncin.; 27th, 4–20; June 4, ova uncin.; 5th, 4–20; 9th, no ova uncin.; 12th, ova uncin.; 18th, 4–20; 24th, no ova uncin.; 30th, no ova uncin. Many Charcot-Leyden crystals. July 5, discharged cured.

Result.—Cured of uncinariasis. Tuberculosis quiescent. Is apparently well and strong but is still emaciated.

Case 26.—J. G. Q., barrio, Caonillas. Admitted May 19. Age 30; male; white; single; laborer on coffee plantation. One year sick. Usual food of country. One month after last attack of mazamorra his anemia began. Has taken iron without betterment. Moderate pallor. No emaciation. No edema. General pruritus. Ulcer on leg. No atrophy of skin. No dryness of skin. Good appetite; gastralgia at times; no nausea nor vomiting; no tenderness of abdomen. Bowels regular. Feces contain many ova uncinaria, Charcot-Leyden crystals, and ova of tricocephalus. Spleen and liver normal. No dyspnea; sometimes palpitation and precordial pain. Pulse 82, strong and full. No cardiac murmur. No cough nor pain in chest. Dizziness; tinnitus aurium; frontal headache; sleeps well; Patellar reflex exaggerated. Is stupid and depressed. Suffers from cold. Urine sp. gr. 1,019, normal. Muscles flabby and painful. Is very weak. Temperature 37.6°.

Course.—Usual for uncinariasis of this degree.

Diagnosis.—Chronic uncinariasis, moderate case but with profound nervous symptoms.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 19	52	2,420,000	9,400	20.8	54.0	15.2	8.8	1.2	.....	.....
26	45	4,417,000	9,600	7.0	72.4	13.0	7.0	.3	0.3	.....
June 2	50	3,764,000	9,800	7.2	80.0	4.8	3.6	.8	3.6	.....
9	61	5,260,000	6,800	4.0	75.2	16.0	3.6	.8	.4	.....
16	85	5,536,000	6,000	3.2	68.0	24.0	3.6	.8	.....	0.4
23	93	5,384,000	6,800	7.2	65.6	18.8	6.0	1.2	.4	.8
30	88	4,840,000	7,000	6.4	53.6	32.0	6.0	1.6	.4	.....
July 7	93	4,968,000	7,200	7.2	56.0	28.8	6.4	1.2	.4	.....
14	93	5,288,000	7,000	16.0	52.4	25.6	3.6	1.2	1.2	.....
21	97	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	100	5,392,000	6,800	10.0	62.4	24.0	3.6	.....	.....	.....

Remarks.—Blood slightly more fluid than normal. Coagulates slowly. Slight poikilocytosis; macrocytes and microcytes. June 28, blood improved steadily to normal.

Treatment.—Blaud's pills used in intervals. May 20, 4–25; 26th, ova uncin.; 27th, 4–25; June 4, ova uncin.; 5th, 4–25; 9th, no ova uncin.; 10th, 4–25; 17th, ova uncin.; 18th, 4–25; 25th, no ova uncin.; 30th, no ova uncin.; July 14, no ova uncin.; August 6, discharged.

Result.—Cured; July 28, all symptoms have disappeared. Rosy complexion.

Case 27.—M. T., barrio, Mameyes Arriba. Admitted May 20. Age 18; male; white; unmarried; field laborer and coffee picker. Mother and two brothers are patients of the commission. History of malaria, slight attack five years ago. Has been sick three years. Diet mainly vegetable, occasionally meat. Always had plenty to eat until became too weak to work steadily. Has taken various home remedies, and patent medicines advertised to cure "anemia," without appreciable effect. Is very pale. Sometimes has edema of face and arms. Has had mazamorra, which left ulcers on legs. Slight pruritus, skin atrophied and dry. Never perspires. Appetite good; gastralgia; nausea and vomiting at times; tongue clean; flatulence; meteorism; pain in abdomen and epigastrium; no ascites. Bowels constipated. Feces contain many ova of uncinaria. Dyspnea on exertion; palpitation and slight pain over heart. Pulse 90, fairly strong and full, but compressible. Very pronounced hemic murmur. No cough. Dizziness, marked tinnitus aurium; severe headache. Sleeps badly. Mental condition and intelligence, good; expression despondent, Impotent. Paresthesias. No eye symptoms. Muscles flabby, painful, sore, and weak. Temperature 37.7° C.

Course.—Progressed rapidly to cure.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 20	24	2,288,000	3,400	8.8	65.2	10.3	14.6	1.1	Not counted.	
27	25	2,288,000	8,400	17.2	45.6	21.2	8.0	1.2	6.4	0.4
June 3	44	3,248,800	5,000	12.0	54.0	13.6	10.8	1.6	6.4	1.6
10	54	4,852,800	5,000	20.0	57.2	6.8	9.6	1.6	4.0	.8
17	62	5,224,000	5,800	13.2	63.2	12.8	9.2	.4	1.2	.....
24	70	6,390,400	4,200	11.2	64.0	8.8	12.0	1.6	2.4	.....
July 1	96	6,214,300	5,200	14.4	62.4	12.4	8.0	1.2	1.2	.4
8	97	5,386,400	7,200	12.8	67.2	11.2	7.2	1.2	.....	.4
15	100	5,600,000	9,000	7.4	72.0	11.6	7.4	1.2	.4	.....
Aug. 1	120	.....	.....	.....	.....	.....	.....	.....	.....	.....

Remarks.—May 20, well marked poikilocytosis and polychromatophilia. Some macrocytes; many microcytes; 40.8 normoblasts per cu. mm.; 27th, 67.2 normoblasts per cu. mm.; one had two nuclei; June 3d, blood improving; 17th, appearance of blood much improved; July 1, blood appears normal.

Treatment.—Blaud's pills given in intervals. May 21, 4–30; 27th, few ova uncin.; 28th, 4–25; June 3d, many ova uncin.; 4th, 4–25; 16th, no ova uncin.; 17th, very few ova uncin.; 18th, 4–30; 24th, no ova uncin.; July 1, no ova uncin.; 8th, no ova uncin.; 17th, no ova uncin. Discharged.

Result.—Cured. Murmur disappeared. Has excellent color.

Case 28.—R. S., Jayuya. Admitted, May 20. Age, 17; male; white; unmarried; laborer in tobacco fields. Family history indefinite; some anemic, some not. Diet, vegetable. Has taken a little medicine from city dispensary. Sickness began about 3 years ago. Very marked pallor; no emaciation; general development good. Skin atrophied and dry; never perspires. Good appetite; no gastralgia; no nausea; no vomiting; tongue clean; no flatulence; no pain in abdomen or epigastrium. Bowels regular. Feces contain great many ova of uncinaria. No dyspnea; palpitation; no pain about heart. Pulse, 114, weak and compressible. Heart not enlarged. Hemic murmur very pronounced. Distinct pulsation in external jugular vein. Dry cough. Dizziness; tinnitus aurium; headache; neuralgia at times; sleeps well. Mental condition and intelligence good. Expression better than usual with such patients. Reflexes slightly exaggerated; impotent; paresthesias. Blurred vision. Muscles weak and flabby. Temperature 36.8°. An interesting case in view of the comparatively slight symptoms in relation to the low hemoglobin.

Course.—Improved with remarkable rapidity at first, then very slowly.

Diagnosis.—Chronic uncinariasis. Very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 22	11	1,616,000	3,200	14.0	51½	20.0	12½	1½	½	.....
29	20	1,821,600	6,000	15.2	56.0	13.2	10.4	2.0	2.4	0.8
June 5	40	3,848,800	4,400	24.0	48.8	9.2	10.4	3.6	3.6	.4
12	54	5,124,000	4,000	30.4	48.0	8.8	11.2	.8	.8	.....
19	73	6,430,400	5,200	42.8	33.6	8.0	9.6	.8	5.2	.....
26	73	5,261,600	9,800	28.8	45.6	10.4	8.4	1.2	5.6	.....
July 3	88	5,475,200	8,600	12.4	68.4	9.6	7.6	.8	1.2	.....
10	90	5,506,400	7,000	16.4	57.2	11.2	11.6	1.6	2.0	.....
17	85	5,635,200	8,800	16.4	66.4	8.8	6.4	.8	.8	.4
24	90	5,426,400	12,400	22.0	44.0	16.4	16.0	.4	.8	.4
31	101	5,532,800	10,600	24.8	56.4	10.0	6.0	.....	.8	.....

Remarks.—May 22, well marked poikilocytosis and polychromatophilia; 12.8 normoblasts to cu. mm. Macrocytes more numerous than microcytes; 29th, 24 normoblasts to cu. mm.; July 3, reds appear practically normal.

Treatment.—Blaud's pills used in intervals. May 22, tr. digitalis and tr. nux vomica; 23d, 3–20; 29th, many ova uncin.; June 1, 4–25; 9th, some ova uncin.; 10th, 4–20; 19th, ova uncin.; 20th, 4–25; 26th, no ova uncin.; July 3, no ova uncin.; 10th, no ova uncin.; 17th, no ova uncin.; 24th, no ova uncin.

Result.—Cured. No heart murmur. His facial expression and color had so changed that acquaintances did not recognize him on his return home.

Case 29.—J. M., barrio, Caguana. Admitted, June 8. Age 23; male; white; unmarried; laborer on coffee, sugar, and tobacco plantations; mother and father died of "anemia." Had measles. Was 5 months in Arecibo City Hospital for "malarial fever." (?) Present sickness began about one year ago with weariness, indigestion, and shortness of breath. Diet usual vegetable food of country people. When financially able, bought various preparations of iron wines, sometimes with benefit, sometimes without. Pallor is well marked; no emaciation; general development good. Feet and ankles edematous. Has had general pruritus, but little mazamorra. Scar of ulcer on left leg. Skin atrophied; dry; no perspiration. Appetite variable; gastralgia; nausea; vomiting; tongue slightly coated; no ascites; some pain in abdomen; flatulence. Bowels, alternating diarrhea and constipation. Feces contain slight amount of mucus and vast numbers of ova uncinaria. Slight dyspnea; palpitation; pain about heart. Pulse, 102; fairly strong; dicrotic; fairly full but compressible. Heart not enlarged. Pronounced hemic murmur. Slight cough, expectoration, and pain in chest. Dizziness; tinnitus aurium; headache at times; no neuralgia. Sleeps well; syncope; reflexes normal. Mental condition fair; usual hopeless expression; intelligence fair; paresthesia. Blurred vision and night-blindness. Muscles flabby, weak, painful, and sore. Has pain in joints. Temperature, 37° C.

Course.—Improved steadily, but very slowly. One of our most stubborn cases. Very difficult to expel all uncinariæ.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 10	24	2,492,800	7,400	15.2	60.4	9.6	11.2	0 8	2.4	0.4
17	26	2,692,800	13,000	12.0	56.0	18.0	11.6	1.2	.....	1.2
24	25	1,977,600	8,200	14.8	53.2	16.0	11.2	2.8	1.6	.4
July 1	29	3,071,040	8,400	23.6	50.0	15.2	10.4	.4	.4	.....
8	35	2,604,000	6,800	22.4	48.8	16.8	10.0	1.6	.....	.4
15	38	2,790,400	8,000	18.0	44.0	26.0	11.2	.4	.....	.4
22	32	3,040,000	8,400	18.4	57.6	13.6	9.2	1.2	.....	.....
29	40	3,328,800	6,000	24.0	47.2	15.6	11.2	2.0	.....	.....
Aug. 5	45	4,340,000	9,000	20.8	50.0	20.8	8.4	.....	.....	.....
19	49	4,500,400	6,400	22.0	55.2	13.2	9.2	.4	.....	.....
12	61	4,804,000	5,000	14.4	60.4	15.6	8.4	1.2	.....	.....

Remarks.—June 10, marked poikilocytosis and polychromatophilia. Macrocytes and microcytes, 88.8 normoblasts, and 29.6 megaloblasts per cu. mm.; 17, 52 normoblasts per cu. mm.; July 1, still poikilocytosis; not so much polychromatophilia. Many more microcytes than macrocytes. One doubtful microblast (33.6 to cu. mm.); 8th 27.2 normoblasts to cu. mm.; 15th, 32 normoblasts to cu. mm. August 5, slight poikilocytosis and polychromatophilia, some macrocytes, more microcytes; 12th, very slight poikilocytosis. Few macrocytes. Many microcytes.

Treatment.—Pills of Vallet's mass given in intervals. June 10, 4–25; 17th, many ova uncin.; 18th, 4–30; 24th, ova uncin.; 25th, 4–30; July 1, ova uncin.; 2d, 4–15, preceded by 0.03 podophyllin; 8th, ova uncin. and embryos of strong intest.; 9th, 4–15, preceded by 0.03 podophyllin; 16th, ova uncin.; 17th, 4–15, preceded by 0.03 podophyllin; 22d, no ova uncin.; many embryos of strong. intest.; 23d, 4–15, preceded by 0.03 podophyllin; 29th, few ova uncin.; 30th, 4–15 preceded by 0.03 podophyllin; August 4, Blaud's pills substituted for Vallet's pills; 5th, ova uncin. Pod. 0.02, calomel 0.26, sod. sulph. 10.; 6th, ext. male fern 8., sod. sulph. 10.; 12th, very few ova uncin.; 13th, 4–15, preceded by 0.03 podophyllin; 19th, no ova uncin.

Result.—Improved. Still has slight hemic murmur. Slight weariness and weakness.

Case 30.—J. M., Jayuya. Admitted, March 29. Age, 30; male; white; single; works on coffee estates; family disease is anemia; mother and two sisters died of it. Has been sick since 12 years of age. Usual country food. Has had much mazamorra. Says he has taken medicine for his anemia ever since he was taken sick but to no purpose. Marked pallor; is fat; at times has general edema; atrophy of skin; "never can perspire." Appetite good; gastralgia; nausea; vomiting; tongue has a few pigmented spots; flatulence; tenderness epigastrium and abdomen; pronounced meteorism; bowels regular; enteralgia at times; feces normal except for many ova of uncinaria. Spleen and liver normal. At times dyspnea; palpitation; very severe precordial pain. Pulse, 97, weak, compressible; decided hemic murmur. There is such a violent supraclavicular pulsation as to make one suppose, at first sight, that he has aneurism. Severe pain in chest. Marked dizziness. ("Ave María! A terrible racket in my ears.") Frontal headache; neuralgia. Insomnia at times. Depressed and hysterical. Has fainting spells. Patellar reflex absent. Complete impotence. Suffers much from cold. Decided paresthesias. Blurred vision. Muscles very flabby, sore, and painful.

Course.—A surprisingly rapid betterment. On 26th of June taken with convulsions which lasted all day. On close questioning and observation we found that he was suffering with hystero-epilepsy. In two or three days was perfectly well.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 29	24	2,581,600	7,800	10.4	70.2	5.2	8.0	2.2	4.0	.....
June 7	32	2,052,800	6,000	7.2	62.0	17.6	6.0	.4	6.0	0.8
12	38	3,088,800	5,400	3.6	76.4	4.4	11.6	.8	2.4	.8
19	55	4,661,600	6,200	10.8	64.4	16.4	6.0	1.6	.8	.....
26	75	4,457,600	7,000	1.2	77.6	10.4	10.4	.....	.4	.....
July 3	103	6,106,600	8,000	4.8	72.8	11.2	6.8	1.2	2.8	.4

Remarks.—May 29, blood very fluid. Coagulates slowly. Decided poikilocytosis but not so extreme as usual. Macrocytes and microcytes, latter predominating; 24.2 normoblasts per cmm. July 3, reds normal. Blood has rapidly improved.

Treatment.—Blaud's pills used in intervals. May 31, 4–30; June 8, ova uncin.; 9th, 4–30; 12th, ova uncin.; 16th, 4-30; 19th, ova uncin.; 20th, 4–30; 26th, bromide soda for hysterical attack 0.630 every 2 hours for 2 days; 28th, no ova uncin., but many Charcot-Leyden crystals; July 3, no ova uncin. Discharged from hospital.

Result.—Cured. July 3. A powerful ruddy man. Only symptom left is some supraclavicular pulsation.

Case 31.—E. M., barrio, Don Alonso. Admitted, May 28. Age 30; male; white; laborer on coffee plantations and banana patches. Three years ill. Usual food of the country. Has mazamorra every year at time of coffee crop. Has taken many iron tonics. Marked pallor; no emaciation; edema of feet and legs; general pruritus; does not perspire; no atrophy of skin but it is dry and harsh. Good appetite; gastralgia; nausea every now and then; tongue normal; flatulence; meteorism; no ascites; constipated; sometimes enteralgia; feces show meat fibers, many ova of uncinaria, Charcot-Leyden crystals. Spleen and liver normal. Dyspnea; palpitation; pain in precordium; pulse, 78, weak and compressible; slight hemic murmur; marked pulsation of vessels of neck. A little cough; much pain in chest. Dizziness; tinnitus aurium; frontal headache; much insomnia; syncope at times; patellar reflex absent; is melancholy and lifeless; impotent; susceptible to cold. Urine: Specific gravity, 1,014, normal. Blurred vision. Muscles flabby and painful. Is very weak. Temperature 37.6°.

Course.—A furfuraceous eruption on extensor surface of forearm, dorsa of hands and face developed while in hospital. Became less marked with time. Otherwise an uneventful, slow recovery.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
May 30	29	2,216,000	7,800	8.4	60.0	19.6	5.6	.....	6.4	.....
June 7	31	1,984,000	7,200	6.0	71.2	19.2	2.4	.....	1.2	.....
13	33	2,768,000	8,400	5.6	73.6	15.6	4.4	.....	.8	.....
20	35	3,168,000	7,400	4.4	78.0	17.2	.4	.....	.....	.....
27	44	3,224,000	7,400	4.0	68.4	26.4	1.2	.....	.....	.....
July 4	42	3,755,200	12,600	8.0	63.6	26.0	2.0	0.4	.....	.....
11	42	4,480,000	9,600	7.2	69.2	20.8	2.0	.....	.4	0.4
18	50	3,408,000	10,400	5.2	71.2	19.6	3.6	.....	.4	.....
25	59	4,256,000	7,600	9.4	64.6	22.0	4.0	.....	.....	.....
Aug. 2	63	4,064,000	8,800	11.2	65.2	21.6	2.0	.....	.....	.....
9	73	4,488,000	7,400	15.2	62.8	17.6	4.0	.4	.....	.....
16	83	5,024,000	8,000	28.0	58.0	10.8	3.2	.....	.....	.....

Remarks.—Usual blood changes. June 20, 29.6 normoblasts per cmm.; July 11, 38.4 normoblasts per cmm. Appearance has gradually improved until it is now about normal.

Treatment.—Vallet's pills used in the intervals. May 31, 4–25; June 8, ova uncin.; 9th, 4–20; 17th, ova uncin.; 18th, 4–20; 27th, few ova uncin.; 28th, 4–20; July 5, no ova uncin.; 11th, ova uncin.; 12th, 4–20; 18th, no ova uncin.; 19th, Vallet's pills changed to Blaud's pills; 26th, no uncin.; August 2, no ova uncin.; August 8, no ova uncin.; 16th, 4–25.

Result.—Practically cured, August 16. Is strong and has no signs of disease save eruption noted. Good color.

Case 32.—B. M., barrio, Guaonico. Admitted, May 31. Age, 25; male; mulatto; single; laborer in country, peon on coffee estates and roads; anemia only disease in his family; father and two brothers died of it, and another is seriously ill now from same disease. Patient has been ill one and a half years. Food: Rice, beans, codfish, and, at times, fresh meat. Ate well while in good health, but lately illness has prevented him from earning his bread. Much mazamorra while picking coffee. Has taken much iron. Pallor marked; has a dirty yellow color. Not emaciated and development good. Edema marked in legs and feet, and slight in face. Has general pruritus. Slight atrophy of skin, which is dry and harsh. "I used to perspire when well, but since I became ill have ceased to do so." Appetite good; gastralgia; no nausea or vomiting; flatulence and tenderness of abdomen; meteorism; bowels normal; sometimes enteralgia; feces, chocolate colored, no blood nor mucus; many ova of uncinaria and ascaris; Charcot-Leyden crystals and meat fibers. Spleen and

liver normal. Dyspnea; palpitation; precordial pain; pulse, 88, strong and full; heart slightly enlarged, with systolic murmur. *Bruit-de-diable* in jugulars, with violent pulsation. No pain in chest. A little cough. Great dizziness; constant buzzing in ears, and temporal headache. Sleep normal. Is downcast and hypochondriacal, with a bewildered air. Has fainting spells. Patellar reflex abolished. Complete impotence for one year. Suffers from cold. Urine, sp. gr. 1,011, normal. Blurred vision. Muscles flabby and painful. Temperature, 38°.

Course.—Ate prodigious quantities of food and suffered from indigestion considerably. Slow case.

Diagnosis.—Chronic uncinariasis, very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 1	19	1,897,600	6,400	16.4	66.0	6.8	2.8	1.6	6.4	.....
8	30	2,008,000	7,600	21.2	63.2	2.4	2.8	.4	10.0	.....
15	31	2,136,000	6,400	46.4	40.0	10.0	2.0	.8	.8	.....
22	32	2,736,000	6,800	46.8	35.2	16.4	.8	.4	.....	0.4
29	28	3,155,200	10,000	38.8	36.2	16.4	4.2	.2	4.2	.....
July 6	28	3,048,000	6,800	23.4	55.2	20.0	.8	.2	.4	.....
13	28	3,176,000	7,600	13.6	62.0	15.6	6.0	1.2	1.6	.....
20	47	3,360,000	9,800	18.8	62.8	16.0	2.0	.4	.....	.....
27	52	4,392,000	10,200	19.6	58.0	18.0	3.6	.8	.....	.....
Aug. 3	63	4,296,000	8,800	34.4	47.2	10.4	6.4	.8	.8	.....
10	67	4,730,000	9,200	36.4	44.0	15.6	2.8	.8	.4	.....
17	86	5,184,000	7.400	26.8	59.2	10.8	2.8	.4	.....	.....

Remarks.—June 1, blood very fluid; coagulates slowly. Poikilocytosis and polychromatophilia. Macrocytes and microcytes. August 10, 36.8 normoblasts per cmm. August 17, 29.6 normoblasts per cmm.

Treatment.—Vallet's pills used in the intervals. June 2, 4–30; 8th, ova uncin.; 9th, 4–30; 16th, no ova uncin.; 17th, 4–30; 22d, no ova uncin.; 28th, no ova uncin.; July 6, few ova uncin. and tricocephalus; 7th, 4–30; 13th, ova uncin.; 14th, 4–30; 20th, ova uncin.; 21st, 4–30; 27th, no ova uncin.; August 3, few ova uncin.; 4th, 4–15, with 0.03 podophyllin; 10th, 4–10, with 0.03 podophyllin; 17th, no ova uncin.; discharged hospital.

Result.—Cured, August 17.

Case 33.—L. R., Jayuya. Admitted, May 31. Age, 12; female; white. Usual food of country. Has been sick eight years. Has mazamorra every year at coffee picking, at which she usually works. Extreme pallor. Not emaciated. Anasarca of extreme grade; even the scalp was edematous. General pruritus; never perspires. Anorexia; gastralgia; nausea; sometimes vomiting; bluish streaks on each side of tongue; flatulence; marked tenderness of epigastrium and abdomen; meteorism; ascites; distension of superficial veins of abdomen; feces, dark yellow color, liquid consistence, no blood nor mucus, many ova of uncinaria and ascaris, and Charcot-Leyden crystals. Spleen and liver much enlarged. Dyspnea; great palpitation; pain in precordium; pulse, 115, weak and dicrotic. Great dilatation of heart, with marked murmurs. No cough; pain in chest. Much dizziness; constant tinnitus aurium; temporo-frontal headache; insomnia; syncope frequent; patellar reflex abolished; tactile sense blunted; great mental depression, seems stupefied; no delirium; susceptible to cold. Urine, sp. gr. 1,012, normal. Blurred vision. Muscles flabby and painful. Great weakness, can not stand. Temperature, 38°.

Course.—This patient was brought to the camp in a hammock, completely prostrated and almost moribund. Never reacted to stimulation and slowly sank, dying in comatose state as from ventricular compression.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 1	9	754,400	14,600	6.8	54.8	29.6	4.0	0.8	4.0	.....
8	15	1,232,000	11,600	20.8	69.6	2.8	2.4	.8	3.6	.....

Remarks.—Blood shows usual changes very marked in character. At both examinations the bacillus was found.

Treatment.—June 1 and 2, stimulation by digitalis and nux vomica; 3d, 2–15; 4th, digitalis and nux vomica; 10th, severe diarrhea set in, and received tannic acid; 11th, many ova uncin.; no thymol given this time. Died that night.

Result.—Died June 11.

Case 34.—T. G., barrio Sabana Grande. Admitted June 5. Age, probably 10; male; mulatto; works about the house. Mother died of anemia, lives with uncle, a patient of the commission. About two months ago was struck across knees; walks with difficulty on account of pain in knees. Anemia began some months ago, with weakness, pains in chest and muscles, and indigestion. Usual food of country, poor in quality. Has never been treated. Pallor marked; no emaciation; under-developed; edema of legs. Has had mazamorra. Scar from ulceration on right leg. Skin atrophied and dry. Appetite good; gastralgia; nausea; vomiting; tongue coated; slight flatulence; slight pain in abdomen and epigastrium. Bowels regular. Feces contain many ova of uncinaria. Slight dyspnea; palpitation; pain about heart. Pulse 90, weak and compressible. Soft hemic murmur. No cough. Dizziness; tinnitus aurium; headache; sleeps well; mental condition and intelligence surprisingly good. Expression weazened. Reflexes normal; syncope. Paresthesias. No eye symptoms. Muscles painful, sore, flabby, and weak. Temperature normal.

Course.—Improved slowly and steadily. Pains in knees have improved, but still walks with some difficulty.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 5	24	3,137,600	.....	20.4	62.4	4.8	6.4	1.2	3.6	1.2
12	24	3,720,000	8,600	29.2	38.4	14.0	10.8	.8	6.0	.8
19	31	3,737,600	7,600	31.6	44.0	6.8	8.0	1.6	6.8	1.2
26	34	3,590,400	7,000	18.8	61.2	8.4	10.8	.4	.....	.4
July 3	32	3,848,800	8,000	24.0	55.2	10.8	7.6	2.4	.....	.....
10	44	4,960,000	9,200	21.6	50.4	16.4	11.2	.4	.....	.....
17	46	5,075,200	7,600	14.4	62.8	9.2	12.8	.4	.....	.4
24	54	4,284,000	10,400	22.0	53.2	14.0	10.0	.8	.....	.....
31	55	4,910,400	5,200	20.0	52.4	13.2	13.6	.8	.....	.....
Aug. 7	58	5,222,400	9,000	14.8	59.2	15.2	10.0	.8	.....	.....
14	60	5,760,000	8,800	10.4	60.8	14.8	12.4	1.2	.4	.....
19	62	5,672,800	10,000	18.4	57.6	17.6	6.0	.4	.....	.....

Remarks.—June 5, moderate poikilocytosis and polychromatophilia. Many macrocytes, less microcytes; July 17, slight poikilocytosis and polychromatophilia. Microcytes now more abundant than macrocytes; August 19, blood appears normal except for numerous microcytes.

Treatment.—Vallet's pills, given in intervals. June 5, 2–15; 12th, ova uncin.; 13th, 2–15; 19th, no ova uncin.; 26th, no ova uncin.; July 3, no ova uncin.; 10th, no ova uncin.; 17th, no ova uncin.; 25th, few ova uncin.; 26th, 2–15; 31st, few ova uncin.; August 1, 3–20, preceded by 0.02 podophyllin; 7th, few ova uncin.; 8th, 3–20, preceded by 0.02 podophyllin; 14th, no ova uncin.

Result.—Greatly improved. Pains in knees improved, but still walks with some difficulty.

Case 35.—M. A., barrio Caguana. Admitted June 7. Age, 35; male; white; unmarried; laborer on coffee and sugar plantations, and on the roads. Some members of family anemic, others not. Has had smallpox. Has been anemic many years, but not severely until last year's coffee picking, when he suffered greatly with mazamorra. States that he had plenty to eat until he became too sick to work. Has taken iron with temporary benefit. Pallor well marked, but not extreme. Under-developed, but no emaciation. Legs slightly edematous. General pruritus; scars on legs from mazamorra ulcers. Marked skin atrophy; dry; no perspiration. Appetite good; gastralgia at times; sometimes nausea and vomiting; tongue clean; no tenderness in abdomen, but some over stomach. Bowels constipated. Feces contain many ova of uncinaria. Dyspnea on exertion; palpitation; sharp pain at times over heart. Pulse 78, weak and compressible. Hemic murmur. No cough. Dizziness; tinnitus aurium; headache; sleeps well; syncope. Mental condition and intelligence good. Expression weazened and woeful. Impotent 5 years. Reflexes good. Paresthesias. Increased susceptibility to cold. Blurred vision. Muscles weak, flabby, sore, and painful. Temperature normal.

Course.—Steady, though not rapid, improvement.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 9	23	2,572,800	6,000	6 4	63.6	12.4	12.8	1.6	3.2	.....
16	27	2,297,600	4,400	2 4	79 2	8.8	5.6	1.6	2.0	0.4
23	29	2,484,600	8,800	6 0	77 6	8.0	6.8	.8	.8	.....
30	30	2,164,000	6,400	3 2	79.2	8.4	8.0	1.2	.....	.....
July 7	40	3,201,600	9,400	4.0	83.2	8.0	4.4	.4	.....	.....
16	42	3,656,000	8,800	4 4	84.4	8.0	2 0	1.2	.....	.....
21	46	3,772,800	9,000	2 4	77.6	9.2	8.8	2.0	.....	.....
29	50	3,448,000	11,600	2 0	79.6	9.2	8.0	.8	.....	.4
Aug. 4	64	4,532,800	7,200	2.8	74.8	12.4	8.4	1.2	.....	.4
11	73	4,524,000	5,000	2.4	70.4	12.8	12.4	1 2	.8	.....
18	77	4,960,000	4,000	5 2	61.2	24.4	8.0	1.2	.....	.....

Remarks.—June 9, slight poikilocytosis and polychromatophilia. Some macrocytes and microcytes; 16th, microcytes more than macrocytes; 17.6 normoblasts per cu. mm.; 23d, lymphocyte with basophilic granules; 18th, appearance of blood has improved steadily until it now looks normal except for microcytes.

Treatment.—Vallet's pills during intervals. June 10, 4-25; 23d, many ova uncin.; 24th, 4-25; July 2d, many ova uncin.; 4-25; 7th, ova uncin.; 8th, 4-25, preceded by 0.03 podophyllin. Left hospital; 15th, Blaud's pills substituted for Vallet's pills. Ova uncin.; 16th, 4-15, preceded by 0.03 podophyllin; 22d, ova uncin.; 23d, 4-15, preceded by 0.03 podophyllin; 29th, ova uncin.; 30th, 4-15, preceded by 0.03 podophyllin; August 4, no ova uncin.; 11th, no ova uncin.; 19th, 4-25.

Result.—Feels perfectly well. Practically cured except for slight hemic murmur;

Case 56.—P. C. S., barrio Angeles. Admitted, June 10. Age 16; male; white; laborer on coffee estates. Disease of family is anemia. Two brothers died of it. Has been four years sick. Usual food of country. Has had much mazamorra. Has taken much iron but in spite of this gets worse every day. Very pale. Not emaciated but underdeveloped. Edema of face and lower extremities. General pruritus; skin always dry; never perspires. No appetite; gastralgia; sometimes nausea and vomiting; flatulence; tenderness of abdomen; meteorism; constipation alternates with diarrhea; sometimes enteralgia. Feces normal save for many ova of uncinaria, Charcot-Leyden crystals, and meat fibers. Spleen and liver normal. Dyspnea; palpitation; precordial pain; pulse, 120, weak. Heart enlarged, blowing systolic murmur. Apex beat low and very marked. Marked pulsation in jugulars. No cough; a little pain in chest. Much dizziness; constant roaring in ears; frontal headache; sleeps well; patellar reflex absent. Tactile sense poor. Is very melancholic. Suffers from cold. Urine, sp. gr. 1,011, normal. Blurred vision. Muscles flabby, painful, and weak. Temperature, 39°.

Course.—Irregular improvement, sometimes slow, at others rapid.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 10	12	1,160,000	4,600	5.2	67.6	11.6	4.4	2.8	8.4	.....
17	12	1,248,000	4,600	9.0	70.0	20.0	1.0	.....	.....	.....
24	20	1,536,000	7,000	12.0	60.0	24.0	2.4	1.2	.4	.....
July 1	30	1,904,000	4,400	14.0	66.0	12.0	4.0	.....	4.0	.....
8	30	2,920,000	7,400	10.0	65.6	19.2	4.0	1.2	.....	.....
15	30	2,960,000	7,200	8.4	60.0	26.0	2.8	2.0	.4	0.4
22	35	3,160,000	7,600	13.2	55.2	24.8	5.6	1.2	.....	.....
29	66	4,304,000	6,200	20.8	49.6	25.2	2.8	1.6	.....	.....
Aug. 5	69	4,472,000	7,000	11.2	52.0	31.2	2.4	2.4	.....	.8
12	86	5,096,000	7,000	7.6	72.0	13.2	6.0	1.2	.....	.....
18	101	5,136,000	7,400	8.6	72.0	14.2	5.0	.2	.....	.....

Remarks.—Usual changes found in severe uncinariasis.

Treatment.—Vallet's pills used in intervals. June 11, 3-20; 17th, many ova uncin.; 18th, 3-20; 25th, ova uncin.; 26th, 3-20; July 1, ova uncin.; 2d, 3-15, with 0.03 podophyllin; 8th, has had diarrhea a week; 9th, no ova uncin.; 10th, 3-15, with 0.03 podophyllin; 15th, no ova uncin.; 16th, changed from Vallet's pills to Blaud's; 22d, no ova uncin., but many Charcot-Leyden crystals; 23d, 3-15, with 0.03 podophyllin; 29th, no ova uncin.; August 5, no ova uncin.; 6th, 3-15, with 0.03 podophyllin; 12th, found ova uncin.; 13th, 4-15, with 0.03 podophyllin; 14th, discharged.

Result.—Cured, August 14. A remarkable change in this boy's appearance and disposition. Color good. Is agile and strong.

Case 37.—M. V., barrio Tetuan. Admitted, June 10. Age, 8; female; white. Sick one and a half years. Usual food of the country. Has had much mazamorra. Has taken iron tonics but without effect. Marked pallor; no emaciation; edema of legs; general pruritus; good appetite; gastralgia at times; no nausea or vomiting; flatulence; bowels constipated; sometimes enteralgia; feces normal but for many ova of uncinaria and ascaris. Charcot-Leyden crystals. Spleen and liver normal. Slight dyspnea; palpitation; precordial pain; pulse, 100, strong and full. Heart a little enlarged. Hemic murmur. Noticeable pulsation of vessels in neck. No cough but pain in chest. Much dizziness. Such roaring in ears as to prevent sleep. Frontal headache. Insomnia. Patellar reflex abolished. Is bewildered and downcast. Susceptible to cold. Urine, sp. gr. 1,012, normal. Blurred vision. Muscles flabby and weak. Temperature 38.5°.

Course.—A rapid and uneventful convalescence.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 11	15	2,468,000	12,600	10.0	65.4	17.6	3.2	0.4	3.2	.....
18	16	2,112,000	7,800	8.8	60.0	29.6	.8	.8	.....	.....
25	30	3,124,000	13,600	9.2	82.8	4.0	.8	.8	2.4	.....
July 2	28	3,088,000	16,000	9.6	67.2	15.2	1.6	2.4	4.0	.....
9	58	4,880,000	10,400	10.4	61.6	23.6	2.0	1.6	.8	.....
16	64	4,504,000	10,800	13.2	59.2	20.8	3.6	1.2	2.0	.....
23	75	4,968,000	13,600	16.4	58.0	21.6	.8	.4	2.8	.....
30	82	5,044,000	15,800	12.8	45.2	36.0	3.2	.8	2.0	.....
Aug. 6	87	6,000,000	10,400	8.4	64.2	22.8	.8	1.0	2.8	.....
13	100	5,168,000	11,400	4.4	70.8	21.6	1.6	1.6	.....	.....

Remarks.—Blood notes not detailed, same as others of same class.

Treatment.—Vallet's pills used in intervals. June 12, 1–10; 20th, ova uncin. 21st, 1–15; 25th, ova uncin.; 26th, 1–15; July 2, ova uncin.; 3d, 2–10, with 0.01 podophyllin; 9th, no ova uncin.; 16th, no ova uncin.; 23d, no ova uncin.; 30th, no ova uncin.; August 6, no ova uncin.; discharged, August 7.

Result.—Cured, August 13. Perfectly well.

Case 38..—M. A. M., barrio Guaonico. Admitted, June 12. Age, 25; female; white; married; housewife and coffee picker. Has had smallpox; 24 days ago, aborted during 6th month of pregnancy. Anemia began about 9 months ago with weariness, pains in joints, and indigestion. Usual vegetable diet. Has taken some medicine from city dispensary; had little effect. Extreme pallor. No emaciation. Well developed. Edema of trunk and lower extremities. Says she never had mazamorra. Some pruritus; skin atrophied and dry. Appetite good; gastralgia; nausea; vomiting; tongue brownish; flatulence; meteorism; pain in abdomen and over stomach. Slight ascites. Alternating diarrhea and constipation. Feces contain slight amount of mucus and great many ova of uncinaria and ascaris lumbricoides. Dyspnea; palpitation; pain about heart. Pulse, 96, weak and compressible; soft, purring, hemic murmur, pulsation very marked in neck. No cough. Dizziness; tinnitus aurium; daily headaches, sleeps well; reflexes abolished. Mental condition, intelligence, and expression, good. Paresthesias. Blurred vision. Looking fixedly in the eyes caused dizziness. Muscular system so weak that she could scarcely walk. Temperature normal.

Course.—Very rapid at first, then slower but steady improvement. Very difficult to expel last few uncinariæ.

Diagnosis.—Acute uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 13	10	880,000	8,600	0.8	75.6	6.0	12.0	2.8	2.8	.....
20	14	1,374,400	8,800	2.0	75.2	10.4	8.8	2.8	.4	0.4
27	29	2,128,800	6,400	4.0	75.2	10.4	9.6	.8	.....	.....
July 4	41	2,550.400	7,600	9.2	70.4	11.6	6.0	1.2	1.6	.....
11	53	3,652.800	6,200	4.8	68.4	16.8	9.2	.8	.....	.....
18	57	3.808,800	4,400	7.2	68.0	11.6	11.2	2.0	.....	.....
25	61	4,120,000	4,000	3.2	79.6	8.8	7.2	1.2	.....	.....
Aug. 1	65	3,850,400	9,400	6.0	78.4	9.6	4.4	1.6	.....	.....
8	71	4,168,800	5,800	4.0	74.0	14.8	6.8	.4	.....	.....
15	76	4,781.600	10,200	.4	80.4	10.4	8.4	.4	.....	.....
19	85	5,354,400	5,200	1.6	84.8	8.0	5.2	.4	.....	.....

Remarks.—June 13, blood watery and coagulates slowly. Marked poikilocytosis and polychromatophilia. Macrocytes and microcytes about equal; 20th, 35.2 normoblasts to cu. mm. 27th, microcytes more numerous than macrocytes; 25.6 megaloblasts and 25.6 normoblasts to cu. mm. June 4, most remarkable improvement during the week; 18th, blood only slightly abnormal; 19th, blood normal except for some microcytes.

Treatment.—Vallet's pills given in intervals. June 14th tr. digitalis and tr. nux vomica; 15th, 4–25; 20th, many ova uncin.; 21st, 4–25; 28th, ova uncin.; 29th, 4–25; improving very rapidly; July 2, stopped digitalis; 5th, many ova uncin.; 6th, 4–15, preceded by 0.03 podophyllin; 11th, ova uncin.; 12th, thymol as previously; 18th, many ova uncin.; 19th, thymol as previously; 25th, many ova uncin.; 26th, thymol as previously; 27th, nux vomica and Vallet's pills stopped. Blaud's pills given. August 1, ova uncin.; 2d, calomel 0.26, podophyllin 0.02; 3d, male fern 8, sod. sulphate 10. Says that it made her more dizzy and sicker than the thymol did. Passed no worms; 9th, ova uncin.; 10th, thymol as previously; 11th, went home; 15th, ova uncin.; 16th, 4–25; 19th, no specimen feces.

Result.—Cured. No heart murmur. Feels perfectly well.

Case 39.—R. R., barrio Guaonico. Admitted June 12. Age, 35; male; white; married; laborer on coffee and banana plantations. Father died of anemia, 12 years ago, also 4 brothers later. Was in good health before last coffee picking, but began to sicken before picking stopped. Had mazamorra while at his work. Illness began with weariness, pains in joints, and indigestion. Food usual, about same before as after became sick. Treated at Utuado in city hospital. Took some powders which gave benefit for a time. Pallor very marked; no emaciation; development good. Edema of legs and feet; pruritus; slight skin atrophy; marked dryness; no sweating. Appetite good; gastralgia; nausea; vomiting; tongue, white-coated; flatulence; meteorism; enteralgia; tenderness over stomach and abdomen; alternating diarrhea and constipation; feces contain many ova of uncinaria; slight dyspnea; palpitation; pain over heart. Pulse 108, weak and compressible; heart not enlarged; pronounced hemic murmur. No cough. Dizziness; tinnitus aurium; headache; sleeps well; fainting spells. Mental condition and intelligence fair. Expression sad and melancholic. Reflexes diminished. Paresthesias. No eye symptoms. Muscles flabby, painful, and very weak. Temperature normal.

Course.—Progressed very slowly at first, then very rapidly after expulsion of all parasites.

Diagnosis.—Acute uncinariasis; very intense case.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 13	13	1,820,800	6,600	1.2	84.8	4.4	5.2	2.0	2.0	0.4
20	15	1,777,600	7,400	1.6	84.0	5.6	6.8	.8	1.2	.....
27	19	2,148,400	7,400	4.8	61.6	24.8	7.2	1.6	.....	.....
July 4	20	2,835,200	7,800	7.2	72.0	11.6	8.8	.4	.....	.....
11	21	3,444,000	6,200	10.0	70.4	12.0	6.8	.8	.....	.....
18	30	3,800,000	8,000	5.2	72.4	11.6	10.0	.8	.....	.....
25	40	4,030,400	9,200	6.0	73.2	12.0	8.0	.8	.....	.....
Aug. 4	55	4,093,800	6,800	7.6	65.6	19.2	7.2	.4	.....	.....
8	66	5,709,600	7,600	7.6	70.8	15.6	6.0	.....	.....	.....
15	87	5,772,800	15,600	9.2	80.4	4.8	5.2	.4	.....	.....
19	92	6,088,800	7,000	12.8	73.2	9.6	4.0	.4	.....	.....

Remarks.—June 13, blood watery and slow to coagulate. Well-marked poikilocytosis and polychromatophilia. Macrocytes and microcytes; 52.8 normoblasts to cu. mm.; 20th, 59.2 normoblasts to cu. mm.; July 11, blood improved somewhat; 24.8 normoblasts to cu. mm.; 18th, 32 normoblasts to cu. mm. August 19, blood appears normal.

Treatment.—Vallet's pills given in intervals. June 15, 4–25; 20th, ova uncin.; 21st, 4–25; 27th, few ova uncin.; 28th, 4–25; July 3, few ova uncin.; 4th, 4–15, preceded by 0.03 podophyllin; 11th, few ova uncin.; 12th, thymol as previously; 18th, no ova uncin.; 25th, no ova uncin. Blaud's pills substituted for Vallet's pills. August 1, no ova uncin.; 11th, left hospital.

Result.—August 19, cured except for slight hemic murmur remaining.

Case 40.—M. T., barrio Mameyes. Admitted June 14. Age 20; mulatto; female; single; coffee picker. Has three brothers under treatment for anemia at clinic. Four years sick. Usual food of country. Mazamorra every coffee crop. Has taken much iron; marked pallor; no emaciation; edema of feet and legs. General pruritus. Skin

dry; does not perspire. Good appetite; flatulence; tenderness of abdomen; meteorism; constipated; enteralgia; feces normal save for many ova of uncinaria, Charcot-Leyden crystals, and meat fibers. Spleen and liver normal. Dyspnea, palpitation, precordial pain. Pulse 120, weak. Marked hemic murmur, and pulsation vessels of neck. No cough; pain in chest. Much dizziness; tinnitus aurium; temporal headache; sleep normal; patellar reflex absent; is cast down and lifeless; menstruation irregular and scanty; susceptible to cold. Urine, sp. gr. 1,014, normal. Blurred vision. Muscles flabby and painful. Great weakness. Temperature 38.5°.

Course.—Soon became so much improved as to do the general washing for the camp.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 15	21	2,264,000	5,000	15.2	58.4	5.6	4.4	2.0	14.4	.....
22	25	2,280,000	6,800	21.2	54.8	18.8	3.6	.....	1.6	.....
29	26	2,888,800	4,600	18.8	50.0	24.0	3.6	1.2	1.2	1.2
July 6	26	3,280,000	11,400	33.2	40.4	21.6	2.0	1.6	1.2	.....
13	26	3,392,000	9,600	20.0	56.0	20.8	2.8	.4	.....	.....
20	37	3,616,000	6,200	32.4	36.8	25.6	.4	2.8	2.0	.....
27	55	4,624,000	13,000	44.0	39.2	15.6	1.2	.....	.....	.....
Aug. 4	64	4,712,000	10,200	36.0	38.4	18.8	3.2	2.8	.8	.....
11	69	5,312,000	7,600	34.4	39.6	20.0	3.2	1.2	1.6	.....
18	84	5,944,000	7,000	35.6	42.8	17.6	2.8	1.2	.....	.....

Remarks.—Blood peculiar for absence of poikilocytosis, otherwise as usual in such cases.

Treatment.—Vallet's pills used in intervals. June 16, 4–25; 22d, great many ova uncin.; 23d, 4–25; 29th, many ova uncin. and Charcot-Leyden crystals; 30th, 4–25; July 6, ova tricocephalus and few ova uncin.; 7th, 4–25; 13th, few ova uncin.; 14th, 4–25, with 0.03 podophyllin; July 16, Vallet's changed to Blaud's pills; 20th, ova uncin.; 21st, 4–10, with 0.03 podophyllin; 28th, no ova uncin.; August 4, no ova uncin.; 5th, 4–10, with 0.03 podophyllin; 11th, no ova uncin.; 17th, no ova uncin. Discharged.

Result.—Practically cured, August 18. Lacks but 1 per cent Hb. of being entirely cured, for she is very well.

Case 41.—M. J. V., barrio Arenas. Admitted, June 6. Age 11; female; mulatto. One year ill. Usual food of the country. Has had mazamorra three times. Has taken much iron. Marked pallor. No emaciation. Edema of face, legs, and feet. General pruritus. Little appetite; gastralgia; nausea; flatulence; tenderness of abdomen; bowels normal; sometimes enteralgia; feces, many ova of uncinaria, some of ascaris, and Charcot-Leyden crystals. Spleen and liver normal. Dyspnea; palpitation; sometimes precordial pain; pulse 125, weak and compressible; heart dilated and murmurs present; marked pulsation of vessels of neck. Much dizziness; constant tinnitus aurium; sleep normal; patellar reflex abolished; is melancholy and lifeless; susceptible to cold. Urine, sp. gr. 1,012, normal. Blurred vision. Muscles flabby and painful. Great weakness. Temperature 39°.

Course.—Uneventful and rapid convalescence.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 9	9	1,624,000	5,800	4.8	61.2	14.8	7.2	1.6	10.4	.....
16	12	1,888,000	8,800	14.4	62.4	8.4	4.4	2.4	8.0	.....
23	17	2,136,000	5,600	27.2	39.6	22.0	4.4	2.8	3.6	0.4
30	45	2,176,000	5,600	14.0	48.0	23.2	8.8	.4	5.6	.....
July 7	60	4,168,000	4,600	12.0	51.2	24.0	7.2	1.2	1.2	3.2
14	70	4,194,000	6,800	31.6	22.4	25.2	13.2	2.0	4.8	.8
21	74	4,480,000	9,200	26.4	52.4	17.6	3.2	.....	.4	.....
28	89	5,016,000	12,200	44.0	34.0	20.0	1.6	.....	.4	.....
Aug. 5	101	5,120,000	9,400	26.4	52.4	17.6	3.2	.....	.4	.....

Remarks.—Blood, usual changes. On the 9th of June, while counting a differential many bacilli of about the size of a colon bacillus were found. They stained blue with Jenner's stain and frequently appeared in pairs end on. They were quite abundant. No spores were seen. Repeated and careful examination of the blood from the ear, and serum from the edematous foot gave the same result. A pure culture was

made, under aseptic precautions by the 3-plate method, which corresponded with others made from other edematous patients with fever. The 16th and 23d of June the same bacilli were noted, after which they disappeared, as did the edema.

Treatment.—Vallet's pills used in the intervals. June 14, 2-15; 24th, ova uncin.; 25th, 2-15; 26th, Vallet's pills changed to Blaud's pills; July 1, ova uncin.; 2d, 2-10, preceded by 0.02 podophyllin; 10th, no ova uncin.; 15th, ova uncin.; 16th, 2-10, with 0.02 podophyllin; 22d, few ova uncin.; 23d, 2-10, with 0.02 podophyllin; 28th, no ova uncin.; August 5, ova uncin.; 6th, calomel 0.130, podophyllin 0.02 followed next morning by 3 extract of filix mas.; 7th, discharged.

Result.—Cured August 14. Is ruddy, fat, and well.

Case 42.—P. C., Adjuntas. Admitted June 15. Age, 12; male; mulatto; formerly lived in country; lately servant in town house. One brother died of anemia. Previous history very indefinite and contradictory. Food better than the average; says he never suffered from hunger. Has taken wine and iron. Pallor well marked; slight emaciation; poorly developed; edema of legs and feet. Pellagra eruption on dorsa of feet, ankles, hands, and wrists, back of neck, and bridge of nose. Ulcer on left foot. Skin atrophied and very dry. Poor appetite; gastralgia; no nausea and vomiting; tongue clean; no flatulence, ascites, nor meteorism. Slight tenderness over stomach and abdomen. Enteralgia at times. Diarrhea, passages frequent but not copious. Feces greenish-black, containing much blood and mucus, vast numbers of ova of uncinaria, ascaris, tricocephalus, and schistosoma mansoni. Dyspnea; palpitation; no pain over heart. Pulse 120, very weak and compressible. Hemic murmur. No cough. No dizziness; tinnitus aurium; no headache. Sleeps poorly; mental condition obtunded; intelligence good; expression passive, apathetic, and timid; reflexes abolished. Paresthesias. Blurred vision. Muscles painful and weak. Temperature normal.

Course.—Became worse then improved a little. Ate almost nothing and became very emaciated. On August 15 was transferred to Arecibo Hospital, where he died October 11, from bilharziosis and uncinariasis. On account of his persistent diarrhea, treatment for uncinariasis was irregular and unsatisfactory.

Diagnosis.—Chronic uncinariasis; intense.

Concomitant diseases.—Bilharziosis recti and pellagra.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 17	31	2,844,000	17,600	2.0	77.2	10.8	6.4	.....	3.6	.....
24	27	2,508,800	12,800	1.2	76.0	13.2	7.6	0.4	1.6	.....
July 1	36	2,835,200	9,600	.8	88.0	7.2	3.6	.4	.....	.....
8	35	2,220,800	17,200	2.0	82.8	12.4	2.8	.....	.....	.....
15	41	2,337,600	18,400	3.2	87.2	6.8	2.8	.....	.....	.....
22	34	2,110,400	10,800	1.6	85.6	9.6	3.2	.....	.....	.....
29	40	2,604,000	15,600	.8	70.0	22.4	6.0	.8	.....	.....
Aug. 5	36	1,812,800	16,600	1.2	84.8	11.2	2.4	.4	.....	.....
12	34	1,891,440	11.400	.4	89.6	9.2	.8	.....	.....	.....

Remarks.—June 17, blood pale; coagulates slowly. Poikilocytosis and polychromatophilia fairly well marked. Macrocytes and especially microcytes plentiful. Blood plates increased. July 1, microcytes numerous and very small. August 12, blood has remained practically the same, although it has fluctuated somewhat.

Treatment.—Blaud's pills in intervals. June 20, 2-20; 24th, many ova uncin. and schistosoma mansoni; 25th, 2-20; 29th, tr. opii camph. for diarrhea; July 1, ova uncin. and schistosoma mansoni; 2d, 2-10, preceded by 0.01 podophyllin; 16th, tonic of tr. nux vom. and tr. cinch. comp. Persistent diarrhea, given tr. opii camph.; 17th, ova uncin. and schistosoma mansoni. Thymol not given on account of diarrhea; 21st, pills of camphor and opium substituted for tr. opii camph.; 22d, given methylene blue for schistosoma mansoni; 26th methylene blue stopped on account of causing burning in stomach; August 7, ova uncin., none of schistosoma mansoni; 8th, 2-10, preceded by 0.01 podophyllin; 13th, pepsin for indigestion.

Result.—August 15, transferred to city hospital, Arecibo. Was in worse condition than on entrance. Died October 11.

Case 43.—M. V. P., barrio Viví Arriba. Admitted June 18. Age, 11; female; white; picks coffee sometimes; mother and three brothers died of anemia. She has been ill one year. Usual food of the country. Fell sick after attack of mazamorra, which from its severity kept her one month in bed. Has taken iron. Marked pallor; skin a dirty yellow color; no emaciation; edema of legs; general pruritus. Good

appetite; gastralgia sometimes; flatulence; constipation; sometimes enteralgia; feces show many ova of uncinaria and ascaris, Charcot-Leyden crystals. Spleen and liver normal. No dyspnea; palpitation; pulse, 88, weak and compressible. Slight systolic murmur, hemic in character. Slightly noticeable pulsation in vessels of neck. No cough but pain in chest. Dizziness, tinnitus aurium; temporal headache very pronounced. Sleep normal. Bewildered condition of mind. No fainting spells. Patellar reflex normal. Quite susceptible to cold. Urine; sp. gr. 1,013, normal. Blurred vision. Muscles flabby and painful. Temperature 38°.

Course.—Rapid convalescence.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 18	20	1,360,000	11,000	8.6	58.4	23.6	4.4	1.4	3.6	.....
25	31	3,208,000	9,600	6.8	63.2	26.4	.8	.4	.....	2.4
July 2	50	3,928,000	7,800	8.0	55.2	25.2	3.6	3.6	4.4	.....
9	68	3,888,000	6,600	10.4	63.6	15.2	2.4	1.6	6.0	.8
16	66	4,024,000	11,600	10.0	50.8	26.0	8.8	4.4	.....	.....
23	72	4,360,000	10,600	10.0	58.8	22.8	5,2	2.8	.4	.....
30	75	4,616,000	9,200	14.0	50.4	22.4	7.6	2.4	1.6	1.6
Aug. 6	101	4,840,000	8,200	14.4	53.2	20.4	8.4	3.6	.....	.....

Remarks.—June 18, blood very fluid and coagulates slowly. Poikilocytosis, etc.

Treatment.—Blaud's pills used in intervals. June 19, 2–15; 25th, ova of uncin.; 26th, 2–15; July 2, ova uncin.; 3d, 2–10, with 0.02 podophyllin; 9th, ova uncin.; 10th, 2–10, with 0.02 podophyllin; 16th, ova uncin.; 17th, 2–10, with 0.02 podophyllin; 23d, ova uncin.; 24th, 2–10, with 0.02 podophyllin; 30th, ova uncin.; 31st, 2–10, with 0.02 podophyllin; August 6, ova uncin.; 7th, calomel 0.13, podophyllin 0.01, followed next day by extract male fern 4; 12th, no ova uncin. Discharged.

Result.—Cured, August 12, a rapid and complete cure; child is perfectly well and ruddy.

Case 44.—P. R., barrio Caonillas. Admitted, June 19. Age. 20; male; mulatto; single; laborer on coffee plantations; about all his family are anemic and are being treated at our clinic. One brother died of anemia some years ago. Has been ill two or three years. Usual country food. Every year during coffee picking has to lay off from 10 to 15 days on account of mazamorra. Has little faith in medicines. Moderate pallor. Has a dead gray color. Is very well nourished. Has had edema of face and lower extremities. Is just recovering from mazamorra and has ulcers on legs. No atrophy of skin. Appetite good; no gastralgia; a little nausea; flatulence; no tenderness of abdomen nor of epigastrium; meteorism; bowels regular; feces, normal except for an enormous number of uncinaria ova. Spleen and liver normal. No dyspnea; palpitation; no precordial pain; pulse, 80, full but dicrotic. Decided hemic murmur. No cough but much pain in chest. Dizziness; tinnitus aurium; headache in frontal region and vertex. Is depressed. Sleeps well. No fainting spells. Patellar reflex abolished. Susceptible to cold. No paresthesias (!). Blurred vision. Muscles, flabby, sore, and painful.

Course.—A rapid convalescence.

Diagnosis.—Acute exacerbation of a chronic uncinariasis; moderate.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 19	40	3,981,600	7,400	20.8	58.0	10.0	6.4	3.6	0.8	0.4
26	46	3,381,600	5,000	23.2	54.4	11.2	7.6	3.6	.....	.....
July 3	65	4,661,600	6,400	12.0	64.8	12.0	9.6	1.6	.....	.....
10	60	5,684,000	12,600	14.4	58.4	14.8	12.0	.4	.....	.....
17	88	6,168,880	10,200	15.6	55.2	13.2	13.2	2.4	.....	.4
24	90	6,564,000	9,000	12.6	62.6	11.6	10.3	1.6	1.3	.....
31	100	7,724,000	9,000	14.0	67.2	8.0	8.4	2.4	.....	.....

Remarks.—June 19, blood very fluid. Coagulates very slowly. Very little poikilocytosis or polychromatophilia. Macrocytes and microcytes relatively infrequent. Reds have very pale centers as in chlorosis; 26th, moderate poikilocytosis and polychromatophilia. Many macrocytes and microcytes. Cells still chlorotic and some

are "stippled." Many degenerate leucocytes. July 17, reds well formed but microcytes still numerous; a great number of blood plates; 31st, same.

Treatment.—Blaud's pills used in intervals. June 23, 4–20, with 0.02 podophyllin; 27th, many ova uncin.; 28th, same as 23d; July 3, many ova uncin.; 4th, same as June 23; 10th, ova uncin. and a few Charcot-Leyden crystals; 11th, same as June 23; 17th, no ova uncin.; 25th, ova uncin.; 26th, same as June 23; 27th, discharged from hospital; August 4, no ova uncin.

Result.—Cured, August 4. Is a remarkably healthy, ruddy man.

Case 45.—G. C. O., barrio Santa Rosa. Admitted, June 20. Age, 8; male; mulatto. Has been sick two years. Usual food of the country. Has had mazamorra. Has taken much iron. Very pale; no emaciation; well developed; edema of feet and legs; general pruritus. Has ceased to perspire since he has been ill. Good appetite; gastralgia; nausea; acknowledged that he ate earth; flatulence; no tenderness abdomen or epigastrium; meteorism; no ascites; bowels constipated; sometimes enteralgia; feces, normal but for many ova of uncinaria and some of ascaris. Spleen and liver normal. Dyspnea; palpitation; precordial pain; pulse, 80, weak and compressible. Slight hypertrophy of heart, and soft blowing systolic murmur. Marked pulsation in vessels of neck. No cough nor pain in chest. Dizziness; constant tinnitus aurium; frontal headache; sleep normal; is stupefied, dazed; patellar reflex abolished. Susceptible to cold. Urine, specific gravity 1,012, normal. Blurred vision. Muscles flabby and painful. Is very weak. Temperature 37.8°.

Course.—Slow but certain convalescence.

Diagnosis.—Chronic uncinariasis; very intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 20	16	1,776,000	7,400	4.8	62.8	22.8	5.2	1.2	3.2	.....
27	18	1,768,000	6,200	9.6	60.8	25.6	2.0	1.6	.4	.....
July 4	17½	1,746,400	5,400	17.6	48.8	23.6	7.6	.8	1.2	0.4
11	23½	2,120,000	4,200	12.4	44.8	34.4	8.0	.....	.4	.....
18	24	2,240,000	5,400	12.0	52.8	28.0	4.4	.....	2.8	.....
25	20	2,256,000	5,200	18.0	42.4	30.0	6.8	2.0	.8	.....
Aug. 1	31	2,448,000	5,200	14.0	55.2	24.4	2.0	1.2	2.4	.8
8	42	3,592,000	7,400	11.6	55.2	30.0	1.2	1.2	.4	.4
15	62	3,976,000	7,600	19.2	51.6	22.4	4.4	1.6	.8	.....

Remarks.—Usual blood changes. June 27, 49.6 normoblasts per cmm.; July 11, 16.8 normoblasts per cmm.

Treatment.—(Blaud's pills used in intervals.) June 22, 2-15; 27th, ova uncin.; 28th, 2-15; July 4, ova uncin.; 5th, 2-15; 11th, ova uncin.; 12th, 2-15; 18th, ova uncin.; 19th, 2-15; 25th, ova uncin.; 26th, 2-15; August 1, ova uncin.; 2d, 2-15; 11th, no ova uncin.; 17th, no ova uncin.; 19th, no ova uncin. Left in charge of Dr. Vizcarrondo, of Utuado, who reports that he became ruddy, strong, and well a month thereafter.

Result.—Cured, September. Hemoglobin percentage not taken.

Case 46.—J. D., barrio Santa Rosa. Admitted, June 21. Age, 19; male; mulatto; single; laborer on coffee estates; some of his family anemic; mother, two brothers, and two uncles died of anemia. Has been sick two years. Usual country food. Has mazamorra at every coffee crop. Has taken much iron to no purpose. Moderate pallor. Skin dark gray. Is well nourished. Slight edema of feet. General pruritus. Has had ulcers from mazamorra on feet. No atrophy of skin, but it is dry and harsh. Good appetite; gastralgia; nausea and vomiting; flatulence; tenderness abdomen and epigastrium; meteorism. Bowels regular; enteralgia. Feces normal save for great quantity of ova of uncinaria. Spleen and liver normal. Dyspnea; palpitation; pain in precordium. Pulse, 100, strong and full. Harsh cardiac murmur best heard at apex. Pulsation at root of neck not noticeable. Cough and pain in chest. Dizziness; tinnitus aurium. Temporal and cerebellar headache; sleeps well. Is very depressed and nervous. Seems afraid he is going to be harmed in hospital, but his anxiety to receive treatment is very apparent. Complete impotence. Very susceptible to cold. Decided paresthesias in legs. Blurred vision. Muscles flabby, sore, and painful. Marked weakness.

Course.—Rapid and uneventful convalescence. His expression changed from one in the depths of woe to that of a sky-larking, happy-go-lucky darky.

Diagnosis.—Chronic uncinariasis of medium severity.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 21	35	2,732,800	8,200	4.0	64.0	25.6	5.2	1.2	.....	.....
28	50	4,008,800	10,400	4.8	70.8	16.4	5.2	1.2	1.6	.....
July 5	54	4,030,400	6,400	2.8	72.8	13.2	10.4	.4	.....	0.4
12	70	4,857,600	9,200	6.0	56.0	19.6	15.6	2.8	.....	.....
19	85	6,856,000	4,000	6.0	54.0	22.8	15.6	1.2	.4	.....
26	104	6,310,400	5,800	4.8	58.0	22.8	13.2	1.2	.....	.....

Remarks.—June 21, blood somewhat pale and fluid, coagulates slowly. Poikilocytosis decided but polychromatophilia little noted. Reds are smaller than usual, microcytes predominating although macrocytes plentiful. Pale centers and spots of degeneration as usual. Leucocytes small and poorly developed. July 5, about same; 26th, reds normal.

Treatment.—(Blaud's pills used in intervals.) June 22, 4-20, with 0.02 podophyllin; 28th, ova uncin.; 29th, 4-15, with 0.02 podophyllin; July 4, ova uncin.; 5th, 4-15, with 0.03 podophyllin; 12th, ova uncin.; 14th, same as on 5th; 19th and 26th, no ova uncin. Discharged from hospital.

Result.—Cured, July 26. In perfect health, spirits, and color.

Case 47.—J. M. B., barrio Tetuan. Admitted, June 21. Age, 30; male; white; married, with five children; laborer on coffee estates; wife and some of his children have anemia; some have not. He was perfectly well until last coffee crop. Food usual of country, but now poor. Previously he had enough to eat because he had a garden, but is now too sick to work it. His last attack of mazamorra, he says, was terrible. Very marked pallor. Has a dirty, pasty yellow color. Has edema of feet and ulcers from mazamorra. Does not perspire. Has little appetite; gastralgia; nausea and vomiting; flatulence; great tenderness of abdomen and epigastrium; constipated; at times enteralgia; feces contain many ova of uncinaria. Spleen and liver normal. Much dyspnea; palpitation; precordial pain; pulse, 115, weak, dicrotic, and compressible. *No heart murmurs.* Veins of arm stand out, pulsate, and each valve is a little elevation. Great pulsation of vessels at root of neck. Cough; no pain in chest. Dizziness; tinnitus aurium; little headache. Is profoundly convinced he is sick, but deeply suspicious of the doctor and prepared for the worst. Subject to fainting spells. Patellar reflex abolished. His expression is most hopeless. Intelligence good; is an astute, hard-headed jibaro. Complete impotence. Susceptible to cold. "Hands feel asleep and tingle." Blurred vision. Muscles flabby, sore, and painful. Marked weakness.

Course.—Recovery rapid. This man, without any organic lesion of heart nor albumin in urine, had a severe edema of both feet, with fever, July 3, which lasted 10 days. He was sent home with 70 per cent Hb., on July 15. On the 27th, he returned with 102 per cent Hb. and bitterly complaining of poor vegetable food.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 22	32	2,195,200	5,000	10.8	66.0	9.6	12.8	0.8	.....	.....
29	62	2,768,800	7,000	4.4	76.0	6.4	10.4	1.2	1.2	0.4
July 6	60	3,360,000	7,000	7.2	65.2	20.8	5.6	.8	.4	.....
13	70	4,061,600	4,000	9.2	67.2	9.6	11.6	1.6	.8	.....
20	93	5,000,000	7,000	5.2	65.2	14.8	12.4	1.2	.8	.4
27	102	6,261,600	7,800	4.8	67.6	17.2	7.2	1.6	1.2	.4

Remarks.—June 22, blood very fluid and coagulates slowly. Polychromatophilia absent. Moderate poikilocytosis; 29th, many macrocytes, fewer microcytes, now decided polychromatophilia. July 6, marked polychromatophilia, but poikilocytosis hardly perceptible. Few macrocytes and microcytes; 13th, several "stippled" reds; many degenerated leucocytes; 20th, many degenerated leucocytes, reds nearly normal; 27th, reds normal.

Treatment.—(Blaud's pills used in intervals.) June 23, 4-15, with 0.03 of podophyllin; 29th, few ova uncin., and many Charcot-Leyden crystals; 30th, same as 23d. For three days had paregoric for diarrhea. July 6 and 13, no ova uncin. Discharged hospital.

Result.—Cured July 27. Is perfectly well and has good color.

Case 48.—R. G., barrio Rio Abajo. Admitted June 20. Age, 28; male; white; married; laborer on coffee and banana plantations. Brother anemic, mother in fair health. Father and three brothers and sisters died of anemia. Has been anemic for some years, gradually getting worse. Had mazamorra each year during coffee picking. Usual food, says that he does not eat as much as he has to eat because it gives him indigestion. Took some "iron powders," but quit as they did him no good. Pallor very marked; slightly emaciated (probably due to indigestion). Development good. Says he has had edema of face, trunk, and extremities; none at present. General pruritis; no ulceration; skin atrophied and dry. Appetite fair; gastralgia; constant nausea; vomiting, almost every day; tongue clean; flatulence; meteorism; pain and tenderness marked over stomach and abdomen. Bowels constipated; feces contain a great abundance of ova of uncinaria. Dyspnea; marked palpitation; precordial pain. Pulse 90, fairly strong. Soft hemic murmur at base and apex. Heart symptoms more pronounced than in some other cases with greater anemia. Dizziness; tinnitus aurium; headache and sometimes neuralgia; sleeps poorly; fainting spells; reflexes slightly exaggerated. Mental condition and intelligence good; expression fair; impotence; increased susceptibility to cold. Paresthesias. Blurred vision. Muscles painful, flabby, and weak. Temperature normal.

Course.—As a general rule improved rapidly, although blood record twice shows fall in hemoglobin, followed by rapid rise.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 21	26	2,517,600	4,800	26.0	42.4	12.8	15.2	0.4	3.2	.....
28	35	3,261,600	6,200	12.8	70.4	6.0	10.4	.4	.....	.....
July 5	45	5,492,800	5,600	19.6	50.0	16.0	13.2	.8	.....	0.4
12	40	4,777,600	7,000	19.6	62.8	11.6	5.6	.4	.....	.....
19	67	6,252,800	10,200	25.2	44.8	14.8	11.6	2.8	.8	.....
26	80	6,266,400	9,000	33.6	35.2	19.6	10.0	.4	1.2	.....
Aug. 2	88	6,786,400	6,000	20.8	55.6	12.4	10.4	.4	.4	.....
10	80	6,555,200	7,600	26.4	50.4	13.6	9.2	.4	.....	.....
17	102	7,008,800	7,200	29.2	46.8	15.2	7.6	1.2	.....	.....

Remarks.—June 21, macroscopic appearance of blood fair. Moderate poikilocytosis and polychromatophilia. Some macrocytes and microcytes, about equal in number; 19.2 normoblasts to cu. mm.; 28th, 49.6 normoblasts to cu. mm. July 5, less poikilocytosis and polychromatophilia. Microcytes more numerous than macrocytes; 67.2 normoblasts to cu. mm.; 12th, 28 normoblasts; 26th, blood appears much improved. Microcytes still numerous. August 10, blood appears normal except for some microcytes.

Treatment.—Blaud's pills given during intervals. June 22, 4–15, preceded by 0.03 podophyllin; 28th, many ova uncin.; 29th, 4–20, preceded by 0.02 podophyllin; July 6, ova uncin.; 7th, thymol as previously; 9th, Dover's powder for diarrhea and irritative cough; 12th, ova uncin.; 13th, 4–10, preceded by 0.02 podophyllin; 19th, few ova uncin.; 20th, thymol as previously; 26th, few ova uncin.; 27th, thymol as previously; August 2, few ova uncin.; 3d, 4–25; 10th, no ova uncin.; 11th, 4–25; 17th, no specimen of feces.

Result.—August 17, cured. Complains of slight indigestion. No heart murmur.

Case 49.—A. G., barrio Arenas. Admitted June 25. Age, 13; male; white. Sister in hospital here for same disease. Another sister and brothers very anemic. Has been sick three years. Usual food of the country. Has had much mazamorra. Has taken much iron. Extreme pallor; no emaciation. Once had general edema. Atrophy of skin, which is dry and perspires very little. Good appetite; gastralgia; nausea and vomiting; tenderness of abdomen and epigastrium; meteorism; bowels regular; enteralgia; feces show an enormous number of ova of uncinaria. Spleen and liver normal. No dyspnea nor precordial pain. Pulse 125, weak, and compressible. No heart murmur. No marked pulsation of vessels of neck. No cough nor pain in chest. Dizziness; tinnitus aurium; frequent temporal headache. Sleeps well. Is depressed and lifeless. Has had fainting spell. Patellar reflex diminished. Has no paresthesias. No disturbances of vision. Muscles flabby, sore, and painful. Is very weak.

Course.—Rapid and uneventful recovery.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L.L.	B.	S.C.	My.
June 28	26	2,284,000	5,800	11.2	48.0	29.6	10.0	1.2	.....	.....
July 5	32	3,524,000	8,200	6.0	49.6	31.6	12.4	.4	.....	.....
12	45	4,706,400	19,600	6.8	54.8	20.0	16.0	2.0	0.4	.....
19	60	4,556,000	9,400	4.8	41.2	32.8	20.0	1.2	.....	.....
26	70	4,888,800	8,200	11 2	43.6	26.0	16.4	2.8	.....	.....
Aug. 2	80	4,817,600	12,600	11.2	59.2	15.6	12.0	.4	1.6	.....
9	77	4,684,000	9,400	17.2	47.6	22.0	11.2	1.6	.4	.....
20	87	.....	.....	.....	.....	.....	.....	.....	.....	.....

Remarks.—June 28, blood very fluid, coagulates slowly. Great poikilocytosis and polychromatophilia. Many macrocytes and microcytes. July 5, reds same as above; 12th, reds improving; 26th, reds nearly normal.

Treatment.—Blaud's pills used in intervals. June 28, 2-10, with 0.03 podophyllin; July 5, ova uncin.; 6th, same as June 28; 12th, ova uncin.; 13th, same as June 28; 19th, few ova uncin.; 20th, same as June 28; 26th, ova uncin.; 27th, same as June 28; August 2, no ova uncin. Discharged from hospital with 80 per cent Hb.

Results.—Cured, August 20; a healthy, ruddy boy.

Case 50.—M. H. V., barrio Viví Arriba. Admitted, June 22. Age, 13; male; white; works on coffee plantation. Anemia is a family disease. One sister died of it. He has been sick four years. Food, poor. Has had mazamorra frequently. Has taken iron tonics, but to no purpose. Very pale; emaciated; no edema; general pruritus at times; skin dry; slight atrophy of skin. Appetite good; gastralgia; nausea and vomiting at times; tenderness in epigastrium; enteralgia; bowels regular; feces, light greenish gray, undigested food, mucus, many ova of uncinaria and ascaris. Spleen and liver enlarged. Dyspnea; palpitation; pulse, 128, strong and full. Pulsation marked in jugulars and arteries of neck. Hemic murmur; no cough; pain in chest. Dizziness; tinnitus aurium; frontal headache; insomnia; is very depressed and lifeless. Patellar reflex diminished. Suffers from cold. Paresthesias of feet. Blurred vision. Muscles flabby. Great weakness. Temperature 39.2°.

Course.—Uneventful and rapid recovery.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 22	27	2,080,000	15,200	2.4	79.2	14.0	3.6	0.8	.....	.....
29	43	2,200,000	11,600	15.2	63.6	10.8	8.8	1.2	0.4	.....
July 6	75	4,741,600	12,000	16.0	53.2	20.8	8.0	1.2	.8	.....
13	60	3,406,400	7,000	16.4	55.2	16.8	9.6	2.0	.....	.....
20	91	4,692,800	6,400	24.8	44.0	14.8	14.8	1.6	.....	.....
27	102	5,832,800	7,600	18.8	58.8	12.0	6.8	3.2	.4	.....

Remarks.—June 22, blood very fluid; coagulates slowly. Great poikilocytosis and polychromatophilia; macrocytes and microcytes in large numbers; 121.6 megaloblasts, 60.8 normoblasts per cmm. Blood is a picture of pernicious anemia; 29th, many more macrocytes than microcytes; 11.6 normoblasts per cmm. July 6, great macrocytosis, many degenerated leucocytes; 13th, reds much improved, little macrocytosis; 20th, reds nearly normal.

Treatment.—Blaud's pills used in intervals. June 23, thymol 2, podophyllin 0.02; 29th, many ova uncin. and ascaris, and great number of Charcot-Leyden crystals; 30th, same as 23d; July 7, ova uncin.; 8th, 2-15, with 0.02 podophyllin; 13th, many ova uncin.; 14th, same as 8th; 20th, ova uncin.; 21st, same as 8th; 27th, ova uncin.; 28th, same as 8th. Discharged from hospital. August 7, no ova uncin.

Result.—Cured, August 7. Boy cheerful and entirely well, with good red color.

Case 51.—F. R., barrio Jayuya Arriba. Admitted, June 22. Age, 30; male; white; unmarried; laborer on coffee, banana, and sugar plantations. Father died of anemia two and one-half months ago; of other members of family, three have anemia, two have not. Says he has always been pallid and weak. Has taken iron tonics with little benefit. Extreme pallor; no emaciation; well developed. Slight edema of feet; has had various attacks of mazamorra; general pruritus; ulcer on right leg; marked atrophy of skin, dry, and finely wrinkled. Good appetite; no gastralgia; no nausea or vomiting; tongue clean; flatulence; meteorism; tenderness over abdomen, but not over stomach; alternating constipation and diarrhea. Feces contain numerous ova of uncinaria. Dyspnea; marked palpitation; precordial pain. Pulse, 88; full and

fairly strong; slight hemic murmur. No cough. Dizziness; tinnitus aurium; headache; sleep variable; fainting spells; reflexes somewhat exaggerated. Mental condition and intelligence good. Expression old, drawn, and pinched; appears about 50 years old. Impotent, increased susceptibility to heat and cold. Paresthesias. No eye symptoms. Muscles very flabby, weak, and painful. Temperature normal. Says he frequently has fever at night.

Course.—Rapid improvement at first, then very slow. Remarkable improvement in skin.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 22	20	2,160,000	6,000	6.0	64.4	12.8	13.2	2.0	1.6	.....
29	30	3,709,600	10,600	16.0	62.8	11.6	7.6	2.0	.....	.....
July 6	38	3,124,000	9,200	15.6	68.0	9.6	6.0	.8	.....	.....
13	50	3,466,400	9,800	10.4	73.6	10.0	4.4	1.6	.....	.....
20	70	3,670,400	5,600	18.0	60.0	12.4	8.8	.8	.....	.....
27	88	4,746,400	4,400	12.4	66.0	14.0	6.4	1.2	.....	.....
Aug. 3	80	5,261,600	8,800	3.2	84.8	8.8	3.2	.....	.....	.....
10	83	5,524,000	4,200	4.4	73.6	12.8	8.4	.8	.....	.....

Remarks.—June 22, blood drop pale. Coagulates slowly. Marked poikilocytosis and polychromatophilia. Macrocytes and microcytes. Few oval forms; 29th, 84.8 normoblasts per cu. mm. July 6, 36.8 normoblasts per cu. mm. 13th, 39.2 normoblasts per cu. mm. Blood much improved; August 10, reds appear swollen, and show slight poikilocytosis and polychromatophilia. Many microcytes. Few macrocytes.

Treatment.—Blaud's pills given during intervals. June 23, 4–20, preceded by 0.03 podophyllin; 29th, many ova uncin. and ascaris lumbricoides; 30th, thymol as previously; July 6, ova uncin.; 7th, thymol as previously; 13th, ova uncin.; 14th, thymol as previously; 20th, ova uncin.; 21st, thymol as previously; 27th, no ova uncin. Left hospital. August 3, no ova uncin.; 4th, thymol as previously; 10th, few ova uncin.; 11th, thymol repeated.

Result.—Practically cured. No heart murmur. Twice walked into camp from home, a six hours' trip, without more than ordinary fatigue.

Case 52.—D. R., barrio Rio Abajo. Admitted, June 22. Age, 15; female; mulatto; unmarried; occupation, housework and coffee picking. Parents in fair health, one sister anemic. Has been sick three or four months. Food, usual, with codfish occasionally. Has taken medicine from city dispensary without appreciable benefit. Pallor marked, but still shows faint color in mucous membranes. General development good, no emaciation. Has had edema of feet, none now. Has had much mazamorra; general pruritus; skin dry and slightly atrophied. Appetite good; gastralgia; nausea, but no vomiting; tongue coated; tenderness over stomach and abdomen; no flatulence, meteorism, nor ascites. Alternating diarrhea and constipation. Feces contain a moderate number of ova of uncinaria, and ascaris. Dyspnea; palpitation; precordial pain. Pulse 108, weak and compressible. Hemic murmur well marked. No cardiac dilatation. Dizziness, tinnitus aurium; headache and sometimes neuralgia; sleep variable; syncope; reflexes slightly diminished. Mental condition stupid; intelligence only fair; expression passive, not as bad as usual; amenorrhea. Paresthesias. No eye symptoms. Muscles not flabby, but painful and weak. Temperature normal.

Course.—Rapid improvement in physical and mental condition, especially after expulsion of all uncinariæ.

Diagnosis.—Acute uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 22	25	3,741,600	13,400	20.4	50.0	17.2	0.8	1.6	2.0	0.3
29	31	2,897,600	6,000	6.8	76.8	11.6	4.4	.4	.....	.....
July 6	45	3,888,000	14,000	14.8	67.2	12.0	5.2	.8	.....	.....
13	53	4,314,400	7,600	14.8	58.4	16.4	8.4	2.0	.....	.....
20	76	5,386,400	12,200	8.8	72.0	9.6	8.8	.8	.....	.....
27	100	5,320,000	8,000	22.0	54.0	15.2	8.0	.8	.....	.....

Remarks.—June 22, blood drop appears slightly pale. Moderate poikilocytosis and polychromatophilia. More macrocytes than microcytes. July 6, microcytes have become more numerous than macrocytes; 27th, reds have improved steadily and now appear normal.

Treatment.—Blaud's pills used in intervals. June 23, 4-15, preceded by 0.03 podophyllin; 29th, ova uncin., few of ascaris and trichocephalus; 30th, thymol as on 23d; July 6, no ova uncin., few of ascaris; 13th, no ova uncin. nor of ascaris; 20th, no ova uncin., one larva strong. intest.; 29th, no ova uncin.

Result.—Rapid cure. Hemic murmur disappeared and menstruation returned.

Case 53.—J. P. C., barrio Caniaco. Admitted, June 23. Age, 12; male; white; coffee picker and servant. Mother and one brother in good health; father and another brother died of anemia. Has been sick five months. Food is the same as mother and brother who have no anemia. Has taken some quinine. Pallor of mucous membranes marked; of face, fair. Good general development; no emaciation; no edema. Has had mazamorra. General pruritus; skin atrophied and dry. Good appetite; gastralgia; nausea; vomiting. Tongue has brown coat; no flatulence; no meteorism; no pain or tenderness of abdomen. Bowels regular. Feces contain a moderate number of ova of uncinaria, and many Charcot-Leyden crystals. No dyspnea nor precordial pain, but some palpitation. Pulse, 102, fairly strong, but compressible. Soft hemic murmur. Dizziness; tinnitus aurium; headache; sleeps well. Reflexes abolished; mental condition very dull; intelligence poor; expression, frightened. No paresthesia. Vision blurred. Muscles weak, but not flabby nor painful.

Course.—Rapid improvement. Became active, more intelligent, and very mischievous.

Diagnosis.—Acute uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 23	25	4,128,000	6,200	7.6	65.2	15.2	10.8	8.0	0.4	.....
30	29	3,772,800	11,800	8.0	68.8	10.4	12.0	.....	.....	0.8
July 7	55	4,737,600	11,800	8.8	66.0	16.8	8.0	.4	.....	.....
14	85	5,337,600	11,200	9.6	69.2	13.2	8.0	.....	.....	.....
21	81	5,346,400	4,600	6.0	63.2	14.4	15.2	.8	.4	.....
28	70	4,372,800	5,000	8.0	54.0	23.6	14.0	.....	.4	.....
Aug. 4	95	5,594,400	4,400	7.6	66.4	17.6	8.0	.4	.....	.....
11	109	6,097,600	8,000	8.0	64.0	20.0	7.6	.4	.....	.....

Remarks.—June 23, blood drop slightly paler than normal. Marked poikilocytosis and polychromatophilia. More microcytes than macrocytes. August 4, reds appear normal. Has improved steadily. Microcytosis was always prominent.

Treatment.—Blaud's pills used during intervals. June 28, 3-15, preceded by 0.03 podophyllin; 30th, ova uncin. (second day after thymol); July 1, thymol as previously; 7th, no ova uncin.; 8th, no ova uncin.; 14th, few ova uncin.; 15th, thymol as previously; 20th, no ova uncin.; 27th, no ova uncin.; 29th, thymol as previously; August 4, few ova uncin.; 5th, calomel 0.13, podophyllin 0.02, filix mas 8., sod. sulph. 10.; 11th, no ova uncin.

Result.—Cured. No heart murmur nor other symptoms. Has fine color.

Case 54.—D. G., barrio Caguana. Admitted, June 22. Age, 16; male; mulatto; laborer on coffee plantations. Anemia is a family disease. Sick one year. Usual food of country. Has had mazamorra. Has taken iron tonics. Pronounced pallor with a puffy look in face. Skin gray, not emaciated; no edema save of face. General pruritus; dry skin. Appetite good; gastralgia; nausea; no vomiting; tenderness of abdomen and epigastrium; meteorism. Bowels regular; no enteralgia. Feces contain many ova of uncinaria and tricocephalus. Spleen and liver enlarged. Dyspnea; palpitation; precordial pain; pulse, 96, weak and compressible. Hemic murmur. Dizziness; tinnitus aurium; headache; insomnia; syncope; reflexes normal; expression is lifeless. Muscles flabby, sore, and painful. Is weak. Temp. 37.5°.

Course.—Rapid and uneventful recovery.

Diagnosis.—Chronic uncinariasis. Moderate severity.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 24	40	4,336,000	4,200	17.0	19.5	35.0	28.5	.....	.....	.....
July 1	34	3,528,000	5,000	24.4	40.4	22.8	12.0	0.4	.....	.....
8	55	4,080,000	6,800	26.8	44.0	16.8	12.4	.....	.....	.....
15	71	4,261,600	6,400	22.8	41.2	19.6	16.4	.....	.....	.....
22	78	4,240,000	5,400	22.4	42.4	21.6	13.6	.....	.....	.....
29	104	5,506,000	5,800	35.2	34.0	16.0	14.8	.....	.....	.....

Remarks.—June 24, blood very fluid and slow to coagulate. Great poikilocytosis and polychromatophilia; enormous macrocytes; 16.8 normoblasts per cmm. July 1, still great macrocytosis; 15th, polychromatophilia and poikilocytosis still very marked but macrocytosis abating; 22d, wonderful improvement in reds; 29th, reds practically normal.

Treatment.—Blaud's pills used in the intervals. June 26, 0.03 of podophyllin, with 15 sod. sulphate; no uncin. expelled; 27th, many ova of uncin.; 28th, 2-10, with 0.03 podophyllin; July 1, many ova uncin.; 2d, same as June 28; 8th, many ova uncin.; 9th, same as June 28; 15th, ova uncin.; 16th, same as June 28; 22d, few ova uncin.; 23d, same as June 28; 29th, ova uncin.; 30th, same as June 28; August 11, no ova uncin. Discharged from hospital.

Result.—Cured, August 11. Boy is healthy and strong.

Case 55.—E. C., barrio Sabana Grande. Admitted, June 23. Age, 12; male; white; two years sick; usual food of country; mazamorra; has taken much iron; pallor marked; no edema; dry skin. Good appetite; no gastralgia; no nausea or vomiting; tenderness in epigastrium; meteorism; bowels regular; feces, only abnormality is large quantity of ova of uncinaria. Spleen and liver enlarged. No dyspnea; no palpitation; no precordial pain. Pulse 76, weak and wiry. Intense hemic murmur; no cough nor pain in chest. Dizziness; tinnitus aurium; headache; sleep normal; patellar reflex diminished. Expression indifferent and lifeless. Muscles flabby and painful. Great weakness. Temperature 37.6°.

Course.—Uneventful rapid convalescence.

Diagnosis.—Chronic uncinariasis in which an acute attack is just about developing; moderate grade.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 24	39	2,560,000	5,400	26.4	30.8	28.0	12.8	1.6	0.4	.....
July 1	34	3,296,000	12,400	22.8	49.4	19.2	7.0	1.2	.....	0.4
8	43	3,106,400	11,800	28.8	47.6	15.2	7.2	.8	.....	.4
15	60	4,164,000	10,000	19.2	41.6	23.2	11.6	1.2	3.2	.....
22	63	5,248,000	11,200	13.3	35.7	22.6	26.0	1.0	1.4	.....
29	73	4,772,800	11,000	14.8	45.6	23.2	12.0	2.4	2.0	.....
Aug. 5	100	5,368,800	15,600	11.6	66.0	10.0	11.6	.8	.....	.....

Remarks.—June 24, blood very fluid and coagulates slowly. Corpuscles fairly well formed. Leucocytes degenerated and eosinophiles large; 43.2 normoblasts per cmm. Decided macrocytosis; polychromatophilia. July 1, great polychromatophilia and macrocytosis. Some macrocytes are enormous; poikilocytosis; 74.4 megaloblasts and 173.6 normoblasts per cmm. Two normoblasts in process of mitosis. Eosinophiles large and leucocytes degenerated. Some polymorphonuclears lack granules, others have large granules, and these cells are of all sizes. July 8, reds better formed but many macrocytes and microcytes; little poikilocytosis and much polychromatophilia; 15th, reds well formed but still macrocytes, microcytes, polychromatophilia and a little poikilocytosis. August 5, blood normal.

Treatment.—Blaud's pills used in intervals. June 26, 0.02 podophyllin and 15. sod. sulphat. no worms expelled; June 28, 2-10, and 0.02 podophyllin; many uncinariæ expelled; July 1, ova uncin.; July 2, same as June 28; 8th, ova uncin. and a few Charcot-Leyden crystals; 9th, same as June 28; 15th, ova uncin.; 16th, same as June 28; 22d, no ova uncin.; 30th, no ova uncin.; 31st, same as June 28; August 5th, no ova uncin. Discharged.

Result.—Cured, August 5. Fat, well, and rosy.

Case 56.—J. G., barrio Caniaco. Admitted, June 25. Age, 23; male; white; unmarried; laborer on coffee plantations. Nearly all of family have anemia; some have died of it. He has been sick several years. Has taken "iron powders" without benefit. Pallor well marked; not emaciated; general development good. Has suffered much with mazamorra. No edema; slight pruritus; skin atrophied, very dry, and harsh. Says he never sweats "a single drop." Good appetite; no gastralgia; no nausea; no vomiting; tongue clean; slight tenderness over stomach and abdomen; no flatulence, meteorism, or ascites. Bowels regular; no enteralgia; feces contain great many ova of uncinaria. Liver and spleen normal. Slight dyspnea; palpitation; sometimes precordial pain. Pulse, 78, full and fairly strong. No hemic murmur. Slight cough, no pain in chest. Dizziness; tinnitus aurium; slight headache;

sleep good; subject to syncope; reflexes abolished; intelligence good; mental condition dull; expression, morose and apathetic. Impotent, susceptible to cold; paresthesias. No eye symptoms. Muscles weak and painful; joint pains. Temperature normal.

Course.—Steady improvement. This man assisted the camp scavenger, and soon informed us that he was better, calling attention to his profuse sweating while at work, as an evidence of that fact.

Diagnosis.—Chronic uncinariasis; intense case.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 25	33	3,221,600	6,000	13.6	63.2	6.0	13.6	0.8	2.0	0.8
July 2	39	3,128,000	7,200	8.8	72.4	10.8	7.6	.4	.....	.....
9	59	3,395,200	8,200	16.4	62.0	13.2	8.0	.4	.....	.....
16	64	4,664,000	4,800	28.0	54.0	12.4	4.0	1.6	.....	.....
23	72	4,195,200	7,000	16.4	66.8	6.8	9.6	.4	.....	.....
30	77	4,301,600	8,800	19.2	63.6	11.6	4.8	.8	.....	.....
Aug. 6	97	6,061,600	11,000	20.4	60.4	10.8	8.4	.....	.....	.....
13	94	5,686,400	10,200	17.6	65.2	11.2	6.0	.....	.....	.....
19	103	5,484,000	9,400	13.6	66.0	16.0	4.4	.....	.....	.....

Remarks.—June 25, macroscopic appearance of blood is fair. Microscopically shows poikilocytosis and marked polychromatophilia. Macrocytes are extremely large, about equal in number to microcytes. July 9, appearance of blood much better than last week. August 6, reds are practically normal.

Treatment.—Blaud's pills used in intervals. June 27, 4–20, preceded by 0.03 podophyllin; July 3, many ova uncin.; 4th, thymol as previously; 9th, many ova uncin.; 10th, thymol as previously; 17th, ova uncin.; 18th, thymol as previously; 23d, ova uncin.; 24th, thymol as previously; 30th, ova uncin.; 31st, ext. filix mas 8., preceded by 0.26 calomel and 0.02 podophyllin. Passed many uncinariæ. August 6, ova uncin.; 7th, filix mas repeated in same manner; 13th, ova uncin.; filix mas repeated; 19th, very few ova uncin. Left camp without taking anthelmintic.

Result.—Cured in regard to his anemia but still retains a few uncinariæ.

Case 57.—U. M., Utuado. Admitted, June 27. Outpatient. Age, 12; female; white; schoolgirl. Family (3 in number) all have anemia. She has always been pale and sickly. Previous disease, measles. Food good now, formerly poor. Has taken purgatives. Slight pallor; no emaciation; well developed. Has had slight edema of ankles. Had mazamorra and resulting small ulcer on leg. General pruritus; skin not atrophied nor dry. Good appetite; gastralgia: nausea; vomiting; flatulence; meteorism; tenderness over stomach and abdomen. Slight diarrhea, feces contain many ova of uncinaria. Dyspnea on exertion; palpitation; pain in precordium; pulse, 99, full and strong; distinct hemic murmur. No cough; slight pain in chest. Dizziness; tinnitus aurium; headache; sleeps well. Mental condition, very good; intelligence, very bright; expression, pleasant; reflexes abolished; paresthesias. No eye symptoms. Muscles sore and somewhat weak. Temperature normal.

Course.—Regular improvement except for an attack of malarial fever which caused a slight set-back.

Diagnosis.—Chronic uncinariasis. Moderate case.

Complication.—Tertian intermittent malarial fever.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 27	56	5,025,600	12,600	14.4	59.6	16.0	8.0	1.6	0.4	.....
July 4	62	4,332,800	12,400	17.2	52.8	17.2	11.6	.....	1.2	.....
11	58	4,484,000	10,200	22.0	56.4	12.4	8.4	.8	.....	.....
18	61	5,657,600	12,400	13.2	63.2	16.0	7.2	.4	.....	.....
25	61	4,737,600	10,200	26.8	46.0	18.4	7.6	.4	.4	0.4
Aug. 1	67	5,364,000	11,600	18.0	58.0	16.8	5.6	1.2	.4	.....
8	75	5,910,400	9,400	18.4	47.6	22.0	10.4	1.6	.....	.....
15	80	6,168,800	6,800	14.0	58.0	18.0	10.0	.....	.....	.....
19	83	6,200,000	12,200	31.6	46.8	13.2	6.4	2.0	.....	.....

Remarks.—June 27, blood drop appears normal. Moderate poikilocytosis and polychromatophilia. Some macrocytes; many microcytes. August 19, 50.6 normoblasts to cu. mm. July 4, 49.6 normoblasts to cu. mm. August 19, blood has steadily improved until it is now practically normal.

Treatment.—No iron was given until July 20. June 28, 2-15; July 11, many ova uncin.; 12, 2-10, preceded by 0.02 podophyllin; 14, chill, fever, etc., diagnosed malaria, and quinine given; 15, no chill, less fever; 16, no fever; 18, ova uncin.; 19, 3-10, preceded by 0.02 podophyllin; 20, began taking Blaud's pills; August 1, few ova uncin.; 2, 3-10, preceded by 0.03 podophyllin; 8, no ova uncin.; 16, 2 ova uncin., 3-10, preceded by 0.02 podophyllin.

Result.—Practically cured. Color good, and feels perfectly well.

Case 58.—M. A. S. C. Utuado. Admitted June 27. Age, 6; male; white; from one of the best known families in Utuado. Sick one month. Previous treatment: He was No. 559 of general series; admitted May 29; very few ova uncin. found; given 1-10; June 6, no uncin.; June 7, 1-15; June 12, no uncin. Returned the 27th of June with heavy infection. Food of best kind. No clear history of mazamorra but had a suspicious eruption between toes. Moderate pallor of mucous membranes but little of general integument. No edema; dry skin. No appetite; gastralgia; nausea; vomiting; tongue white coated; no tenderness of abdomen or epigastrium; constipation; no enteralgia. Feces, dark and semi-liquid, enormous number of ova of uncinaria, some of ascaris and tricocephalus (the largest number of ova we have seen). Spleen and liver normal. Breathless on slightest exertion. Palpitation; no precordial pain. Pulse, 96, a little weak and compressible. Short dry cough; no pain in chest. Dizziness; tinnitus aurium; no headache; sleeps well but uneasily; is very nervous and cries on being approached with lancet for puncturing ear, a rare circumstance as we have found among these children. Reflexes normal. Temperature, 36.9°.

Course.—This remarkable case was very carefully studied. The only possible skin infection must have occurred a couple of months before his first coming to clinic (May 29). The extraordinary blood record was repeated to insure its correctness.

Diagnosis.—Acute uncinariasis; light case.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 27	65	4,352,000	7,200	9.5	57.5	27.5	2.0	0.5	3.0	.....
July 4	107	5,346,400	9,000	7.2	55.2	22.4	14.4	.4	.4	.....

Remarks.—June 27, blood fluid and coagulates slowly. No poikilocytosis nor polychromatophilia.

Treatment.—No iron used.

June 28, 2-15, preceded by 0.01 of podophyllin. July 4, no ova uncin.

Result.—Cured, July 4. It is remarkable that his symptoms should disappear in so short a time, but he is perfectly well now.

Case 59.—S. O. Barrio Salto Arriba. Admitted June 28. Age, 35; female; mulatto, widow; housework and coffee picking. One brother died of anemia. She has been sick for several years, very ill for one year. Does not remember the beginning. Vegetable food, poor quality. Has taken "reconstituent pills," which did not reconstitute. Pallor very marked; no emaciation; development good. Has had puffiness of face; has now slight edema of trunk and legs. Had mazamorra; no pruritus; skin very dry and atrophied. Good appetite; gastralgia; little nausea and vomiting; flatulence; meteorism; ascites; tenderness over epigastrium and abdomen. Bowels irregular, alternating diarrhea and constipation; no enteralgia. Feces contain many ova of uncinaria. Dyspnea; much palpitation; pain over heart. Pulse, 126, very weak. Very pronounced hemic murmur, and scarcely detectable dilatation of heart. Pulsation in external jugulars. No cough. Great dizziness; tinnitus aurium; headache; no neuralgia; sleeps poorly; subject to syncope; reflexes good; mental condition, very bad; intelligence, scarcely any; expression, picture of misery. Paresthesias. Amenorrhea for 9 months; aborted about one year ago. Blurred vision. Muscles, very flabby, sore, and painful. Is too weak to walk without assistance. Temperature normal.

Course.—Made no progress for three weeks, then improved rapidly. Towards end was cook's helper.

Diagnosis.—Chronic uncinariasis; intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
June 28	18	1,212,600	11,200	4.8	72.8	6.4	16.0	.....	.....	.....
July 5	22	1,332,800	10,600	2.4	70.8	9.2	17.2	0.4	.....	.....
12	16	964,000	5,600	8.4	79.2	6.4	6.0	.....	.....	.....
19	20	1,070,400	6,000	6.0	74	7.2	10.8	.....	0.4	1.6
26	30	2,408,800	2,200	2.0	70.8	9.2	15.2	.4	2.4	.....
Aug. 2	50	2,924,000	7,400	2.8	81.2	8.	6.8	.8	.4	.....
9	67	4,332,800	5,600	4.0	74.4	8.4	12.0	.4	.8	.....
16	74	4,530,400	4,600	7.6	75.2	8.8	8.4	.....	.....	.....
19	75	4,842,800	7,400	4.4	68.0	14.4	12.4	.8	.....	.....

Remarks.—June 28, blood pale, watery, and coagulates slowly. Extreme poikilocytosis and polychromatophilia, macrocytosis prevails. July 5, 42.4 normoblasts to cu. mm. 12th, reds are greatly deformed. Macrocytes are most numerous and of great size, many larger than leucocytes. 67.2 megaloblasts and 44.8 normoblasts to cu. mm. 26th, reds improved. Still macrocytosis but cells appear less "washed out;" 8.8 megaloblasts and 8.8 normoblasts to cu. mm. August 2d, appearance of blood much better. 19th, blood appears almost normal.

Treatment.—Blaud's pills used in intervals. June 30, 4–15, preceded by 0.03 podophyllin; July 4, tr. digitalis and tr. nux vomica; 6th, ova uncin.; 7th, thymol repeated; 13th, many ova uncin.; 14th, thymol repeated; 19th, few ova uncin.; 20th, thymol repeated; 26th, few ova uncin.; 27th, thymol repeated; August 2d, no ova uncin.; 8th, no ova uncin.; 13th, stopped digitalis and nux vomica; 19th, no ova uncin.

Result.—The improvement in this patient is remarkable. Has good color, no edema, slight murmur. Feels well except for some weakness.

Case 60.—M. G., barrio Mameyes. Admitted, July 4. Age, 13; male; white; works sometimes on coffee plantations. Three brothers died of anemia. He has been ill six years. Has usual food of country. Has had much mazamorra. Has taken much iron. Marked pallor. Not emaciated. Edema of legs. General pruritus. Good appetite; sometimes gastralgia; nausea; no vomiting; flatulence; no tenderness of abdomen; some meteorism; constipated; sometimes enteralgia; feces, many ova of uncinaria, Charcot-Leyden crystals, and some ova of ascaris. Normal spleen and liver. Slight dyspnea; palpitation; precordial pain. Pulse, 90, strong and full. Heart enlarged, with systolic hemic murmur. Pulsation of vessels of neck pronounced. No cough, but pain in chest. Much dizziness and tinnitus aurium; temporal headache. Sleep normal; reflexes normal. Expression sad and lifeless. Susceptible to cold. Urine; 1,014, normal. Blurred vision. Muscles flabby, painful, and weak. Temperature, 38°.

Course.—Rapid convalescence.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
July 7	19	2,360,000	10,800	6.8	50.8	36.0	5.6	0.8	.....	.....
14	32	2,504,000	7,200	12.0	53.6	23.2	5.6	1.2	4.4	.....
21	58	3,800,000	5,600	11.2	57.2	29.2	.8	.8	.8	.....
28	66	4,064,000	7,200	24.8	44.4	20.4	3.2	3.6	3.6	.....
Aug. 3	90	4,808,000	8,200	18.8	40.4	32.8	3.6	.8	3.6	.....
10	.....	4,824,000	8,600	16.0	42.4	29.2	4.0	3.6	2.8	2.0

Remarks.—Usual blood changes for this type.

Treatment.—Blaud's pills used in intervals. July 8, 3–10, with 0.02 podophyllin; 14th, many ova uncin.; 15th, 3–10, with 0.02 podophyllin; 21st, many ova uncin.; 22d, 3–10, with 0.02 podophyllin; 28th, ova of uncin. and ascaris; 29th, 3–10, with 0.02 podophyllin; August 2, ova uncin.; 4th, 3–10, with 0.02 podophyllin; 11th, no ova uncin.

Result.—Cured, August 11th, perfectly healthy and of good color.

Case 61.—J. J. I., barrio Roncador. Admitted, July 17. Age, 11; male; white; coffee picker; his mother died of anemia; he has been sick one year; usual food of country; mazamorra often; has taken much iron. Marked pallor; not emaciated; edema face and legs; no atrophy of skin. Good appetite; gastralgia; no nausea or vomiting; flatulence; tender abdomen; meteorism; bowels constipated; sometimes enteralgia; feces contain many ova of uncinaria, Charcot-Leyden crystals, and meat fibers. Spleen and liver normal. Dyspnea; palpitation; precordial pain; pulse, 112 and weak. Slight hemic murmur and pulsation in vessels of neck noticeable. No cough nor pain in chest. Dizziness; much tinnitus aurium; frontal headache; sleep normal; patellar reflex absent. Is very dispirited. Susceptible to cold. Urine; S. G. 1,010, normal. Blurred vision. Muscles, flabby and painful. Is very weak. Temperature 38°.

Course.—Very rapid convalescence.

Diagnosis.—Chronic uncinariasis, intense.

Date.	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.	S. C.	My.
July 17	22	1,576,000	8,200	2.0	78.8	18.4	0.8	.....	.....	.....
24	42	2,960,000	10,400	22.0	61.6	14.4	.4	1.2	0.4	.....
31	64	3,356,000	5,800	16.0	48.8	26.0	6.8	1.2	.4	0.8
Aug. 7	71	3,656,000	5,400	24.4	48.4	17.6	6.8	2.4	.4	.....
14	87	4,744,000	11,200	26.8	52.8	18.0	2.4	.....	.....	.....

Remarks.—Usual blood changes of severe grade of uncinariasis.

Treatment.—Blaud's pills used in the intervals. July 18, 2–10, with 0.02 podophyllin; 24th, ova uncin.; 25th, 2–20, with 0.02 podophyllin; 31st, no ova uncin.; August 2, 2–30, with 0.02 podophyllin; 7th, no ova uncin.; but many Charcot-Leyden crystals; 17th, no ova uncin. Discharged from hospital.

Result.—Cured, August 17. Perfectly well. Good color.

THE AIBONITO SERIES OF 1905.

BETANAPHTHOL GROUP—THYMOL GROUP.

These two groups are formed of cases continuously under observation in hospital in whom all worms expelled as a result of the specific drugs were counted. Our technique was as follows:

All feces for 24 hours after the administration of the first dose of the drug were saved. This was strained into a bucket through several thicknesses of gauze and the filtrate well and repeatedly washed. This latter was then washed out into porcelain dishes, in which there had been placed a 4 per cent solution of formaldehyde. The dishes were then carried into a separate room, where a gutter painted a jet black had been mounted so as to run into another bucket through a very gentle incline. Starting at the upper end of this gutter a very few drops of the filtrate were allowed to fall into the gutter and this material was thus dispersed in a thin layer over the surface, so as to expose all solid elements. Then with a fine stream of water from a wash bottle and a pair of thumb forceps the worms were recovered. A full count generally required from one to two hours, and of all that we have had to do in investigating this disease we can not conceive of a more tiresome, disgusting, and unhealthful labor. While there are but 70 cases here, as a matter of fact fully 70 more were begun and had to be abandoned when patients, feeling well, insisted on leaving camp for their homes, thus spoiling the records and ruining the case for scientific ends.

The clinical histories are exceedingly brief, and only such points in the course of the cases are noted as seem to lend especial interest. A few cases were at first treated with male fern, but when the futility of that drug was demonstrated the regular medication was applied.

The blood record is incomplete. It was physically impossible for us to make a complete record and, in view of the previous year's study, unnecessary. So merely the hemoglobin is noted from time to time.

These records have never been heretofore published, although they are the most valuable of our series.

Attention is invited to the large number of cases in whom the later doses of the anthelmintic were those which brought away the largest worms. This is contrary to early observations on uncinariasis, but there is no doubt in our minds that it is the small-sized and not the large-sized uncinariæ which are first expelled. In this connection it will be noted that sometimes 18 and more hours passed after the administration of the anthelmintic before worms were expelled.

Fever, diarrhea, and albuminuria were frequently seen during the course of treatment. The first was generally dispelled after the first dose of the anthelmintic; the second was more frequently occasioned by thymol, and the third symptom by betanaphthol.

The remarkable lack of effect of iron in the anemia of uncinariasis may be seen by comparing the rise of Hb. in those who did and those who did not receive that drug.

Series of 30 cases of uncinariasis treated by betanaphthol.

Case, 5802; age, 18; sex, male; grade, intense; no iron used in this case; anthelmintic; betanaphthol; total days, 42; total rise Hb., 27 per cent; total uncinariæ expelled, 1,316.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 30	Moderate	2.0	432	18	
Nov. 6	Many	2.0	495	17	
13	Moderate	2.0	233	25	
19	do	2.0	76	31	
27	Few	2.0	70	28	
Dec. 4	do	2.0	10	45	
7					Headache.
10					Much albumin and casts.

Case, 5655; age, 35; sex, male; grade, intense; Blaud's pills used; anthelmintic, betanaphthol; total days, 44; total rise Hb., 43 per cent; total uncinariæ expelled, 1,122.

Oct. 24	Many	2.0	507	21	No albumin in urine.
25			161		Worms passed result of yesterday's dose.
Nov. 1	Many	2.0	273	26	
6					Chill and fever.
7	Moderate	2.0		29	
8			67		Result of yesterday's dose.
15	Moderate	2.0	29	29	
22	do	2.0	80	39	
29	Few	2.0	5	49	
Dec. 6	None			64	

Case, 6089; age, 50; sex, female; grade, medium; tincture chloride iron used; anthelmintic; betanaphthol; total days, 30; total rise Hb., 47 per cent; total uncinariæ expelled, 333.

Nov. 24	Many	1.0	312	35	
Dec. 2	Few	1.0	9		
9	Moderate	1.0	12	45	
19	None	1.0			
23				82	

Case, 5434; age, 12; sex, female; grade, intense; Blaud's pills used; anthelmintic; betanaphthol; total days, 38; total rise Hb., 52 per cent; total uncinariæ expelled, 864.

Oct. 14	Moderate	2.0	305	34	Three small ascarides expelled.
23	Many	2.0	414	40	One pair uncinariæ in copulation. Also expelled one ascaris.
29					Vomited; severe headache; slight diarrhea. Urine shows slight trace of albumin; few hyaline and granular casts only.
Nov. 4	Many	2.0	130		
Oct. 10				59	Trace of albumin; moderate number of hyaline casts; very few granular casts.
Nov. 11	None	2.0	15	68	
20	do	2.0		86	

Case, 5676; age, 10; sex, female; grade, medium; Blaud's pills used; anthelmintic; betanaphthol; total days, 36; total rise Hb., 36 per cent; total uncinariæ expelled, 406.

Oct. 24	Moderate	2.0	387	53	No albumin in urine.
31	Few	2.0	19	55	
Nov. 6	None	2.0		64	
10	do	2.0		73	Faint trace of albumin; no casts.
21				79	
29				89	

Series of 30 cases of uncinariasis treated by betanapthol—Continued.

Case, 4933; age, 18; sex, female; grade, intense; Blaud's pills used; anthelmintic; betanaphthol; total uncinariæ expelled, 542. Was very hysterical on admission; later became normal.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Sept. 22					Fever averages 102 to 105; no parasites in blood; delirium.
23					Chill followed by fever, 105.
24					Temperature 98.4. No parasites in blood.
25					Temperature normal.
26					Temperature 103 at 12 noon.
27					Temperature: a. m., 101; 12 m., 104; 6 p. m., 102.
29					Temperature: a. m., 100; 12 m., 100; 6 p. m., 100. Quinine given.
Oct. 8					Temperature normal for three days.
10	Moderate	2.0	469		
20	do	2.0	32	79	
29	Few	2.0	18		
Nov. 6				95	Vomiting. Trace of albumin in urine.
13	None	2.0	11	88	
20	Moderate	2.0		100	
27	None	2.0	12		
Dec. 5	do	2.0			

Case, 5807; age, 28; sex, female; grade, medium; no iron used in this case; anthelmintic; betanaphthol; complication, chronic otitis media; total days, 15; total rise Hb., 61 per cent; total uncinariæ expelled, 497.

Oct. 30	Moderate	2.0	325	35	
Nov. 7	do	2.0	128		
10				81	
14	Moderate	2.0	1	96	
21	do	2.0	14		
25					Joint pains, severe.
29	Moderate	2.0	17		
Dec. 6	do	2.0	12		
16	None	2.0	0		Thymol used this time.

Case, 4243; age, 9; sex, male; grade, medium; Blaud's pills used; anthelmintic; betanaphthol; total days, 26; total rise Hb., 23 per cent; total uncinariæ expelled, 247.

Sept. 12	Few	1.0	242	65	Trace of albumin, before treatment began.
20	do	1.0	3		
28	None	1.0	1		No albumin before dose.
Oct. 1				88	
5	None	1.0	1		

Case, 5944; age, 10; sex, male; grade, medium; Blaud's pills used; anthelmintic; betanaphthol; total days, 24; total rise Hb., 58 per cent; total uncinariæ expelled, 654.

Nov. 6	Many	1.0	626	35	
13	Moderate	1.0	9	49	
21	None	1.0	19	79	
29	do	1.0	0	93	

Case, 4241; age, 11; sex, male; grade, benign; Blaud's pills used; anthelmintic; betanaphthol; total days, 30; total rise Hb., 13 per cent; total uncinariæ expelled, 680.

Sept. 12	Moderate	2.0	675	81	Diarrhea.
20	None	2.0	5		Diarrhea had ceased.
28	do	2.0	0		
Oct. 1				94	
5	None	2.0	0		

Series of 30 cases of uncinariasis treated by betanapthol—Continued.

Case, 3204; age, 13; sex, male; grade, intense; Blaud's pills used; anthelmintic; betanaphthol; total days, 57; total rise Hb., 70 per cent; total uncinariæ expelled, 1,727.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Aug. 17	Moderate	2.0	1,569	29	No albumin. Pieces of betanaphthol, forming cast of capsule, passed entire.
26	Few	2.0	106		
Sept. 1					Uremic convulsions; promptly relieved by treatment.
7					Diarrhea.
9				75	
11	Few	2.0	36		
14					Convulsions ending in stupor, relieved by pilocarpine.
19			8	99	
25	Few	2.0	8	96	
28					Albumin in urine; no casts.
Oct. 1				99	
3	None	2.0	0		

Case, 4197; age, 7; sex, male; grade, very intense; Blaud's pills used; anthelmintic, betanaphthol; total days, 39; total rise Hb., 78 per cent; total uncinariæ expelled, 1,778.

Sept. 10	Many	1.0	1,587	20	
14					Diarrhea.
22	Few	1.0	141		Diarrhea has ceased.
29	Moderate	1.0	22	58	
Oct. 5	do	1.0	18		
14	None	2.0	10		
18				98	

Case, 3476; age, 10; sex, female; grade, intense; Blaud's pills used; anthelmintic, betanaphthol; total days, 35; total rise Hb., 70 per cent: total uncinariæ expelled, 650.

Aug. 23	Moderate	2.0	591	18	
Sept. 1	do	2.0	7		Diarrhea.
8	None	2.0	3		Diarrhea had ceased.
13	do	2.0	49		
20	do	2.0	0		Thymol used this time.
27	do	2.0	0	98	Traces of albumin in urine; no casts.

Case, 5237; age, 12; sex, male; grade, intense; reduced iron used; anthelmintic, betanaphthol; total days, 39; total rise Hb., 40 per cent; total uncinariæ expelled, 1,108.

Oct. 9	Moderate	2.0	725	18	
16	do	2.0	166		
23	do	2.0	76	19	
29				37	
30	Moderate	2.0	12		
Nov. 5				34	
6	Moderate	2.0	0		
12				47	
16	Moderate	2.0	117		
23	do	2.0	12	58	

Case, 5848; age, 24; sex, male; grade, very intense; no iron used; anthelmintic, betanaphthol; total days, 18; total rise Hb., 11 per cent; total uncinariæ expelled, 235.

Nov. 1	Many	2.0	115	33	
10	Moderate	2.0	103	44	
18	None	2.0	17		

Series of 30 cases of uncinariasis treated by betanapthol—Continued.

Case, 3206; age, 23; sex, male; grade, very intense; (one of the most intense cases we have ever seen, and almost dead when admitted, from long standing anemia; hypostatic congestion of lungs; general glandular enlargement; fever; presence of a bacillus corresponding to the bacillus coli group; found by direct culture from blood; general severe anasarca and death-like pallor; Blaud's pills used; anthelmintic; betanaphthol); total days, 60; total rise Hb., 77 per cent; total uncinariæ expelled, 2,234.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Aug. 14				8	
17					Temperature 38¼° C.; a trace of albumin; granular and hyaline casts.
Aug. 19–Sept. 2					Temperature ranges from normal or subnormal in the morning to from 37½° to 38° C. at night. Sputum contains no tubercle bacilli on repeated examinations. Not at all emaciated. On September 2 fever disappeared, and as man was nearly dead from anemia, betanaphthol was administered.
Sept. 3	Moderate	2.0	2,007	12	
8				20	
10	Few	2.0	201		Slight trace of albumin in urine, not discernible by Heller's test. No casts, but few polymorphonuclear leucocytes.
17	None	2.0	15		
24	do	2.0	2		
30	do	2.0	8	50	All worms expelled are very large.
Oct. 12	do	1.0		85	This man became an employee of the pharmacist of Aibonito. His hemoglobin rose to 105 per cent eventually, and he was known as "el colorado," the red-faced man. On admission he was apparently so stupid as not to understand the simplest things said to him. He developed into an unusually bright messenger.

Case, 3475; age, 45; sex, female; grade, intense; lactate of iron used; anthelmintic, betanaphthol; total days, 21; total rise Hb., 47 per cent; total uncinariæ expelled, 1,566. (+?)

Aug. 24	Moderate	2.0	804		
31	do	2.0	(?)	58	Stool lost.
Sept. 12	Few	2.0	379		Diarrhea.
19	do	2.0	279		
26	do	2.0	66		
Oct. 3	None	2.0	38	105	
10	do	2.0			

Case, 3783; age, 6; sex, female; grade, medium; Blaud's pills used; anthelmintic, betanaphthol; total days, 28; total rise Hb., 62 per cent; total uncinariæ expelled, 73.

Sept. 4	Moderate	2.0	63	25	
10					Albumin in urine, no casts.
12	Few	2.0	10		I have carefully investigated to see if by chance any of the evacuations this child were not saved and there is no doubt that none were lost, nor any part of her excrement for 12 hours after each dose of the anthelmintic. (Note by Dr. Ashford, whose case this was.)
19	None	1.0			
Oct. 1				87	

Series of 30 cases of uncinariasis treated by betanapthol—Continued.

Case, 4647; age, 60; sex, female; grade, intense; Blaud's pills used; anthelmintic, betanaphthol; total uncinariæ expelled, 542.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Sept. 21	Many	2.0	386		
27	Moderate	2.0	54		
30				65	
Oct. 3	Few	2.0	89		All uncinariæ large; also expelled 34 tricocephali.
11	Moderate	2.0	11		
20	None	2.0	2	60	

Case, 3605; age, 22; sex, female; grade, intense; Blaud's pills used; anthelmintic, betanaphthol; total days, 47; total rise Hb., 34 per cent; total uncinariæ expelled, 1,387.

Aug. 28	Moderate	2.0	978	57	Slight trace of albumin before treatment.
Sept. 2					Diarrhea.
4					Diarrhea ceased.
8	Few	2.0	258		All very large uncinariæ.
15	Moderate	2.0	26	50	
21	do	2.0	56		
Oct. 1	do	2.0	65	91	All very large uncinariæ.
13	Some	2.0	4		No albumin, all large uncinariæ.
20				94	

Case, 3356; age, 12; sex, male; grade, intense; saccharated oxide of iron given; anthelmintic, betanaphthol; total days, 36; total rise Hb., 75 per cent; total uncinariæ expelled 2,724.

Aug. 18					Moderate amount of albumin and casts.
21	Many	2.0	2,372	24	Very small stool almost entirely composed of worms.
29	do	2.0	307		
Sept. 1				47	
5	None	2.0	28		
8				99	
14	None	2.0	17		All uncinariæ expelled were large.
22	do	2.0		90	

Case, 3190; age, 50; sex, male; grade, intense; iron, quinine, and strychnine used; anthelmintic, betanaphthol; total days, 49; total rise Hb., 75 per cent; total uncinariæ expelled, 995.

Aug. 16					No albumin in urine.
17	Few	2.0	503		Slight trace of albumin in urine.
19					No albumin in urine.
21				23	
23	Few	2.0	235		
30	do	2.0	92	35	Slight trace of albumin in urine.
Sept. 6	do	2.0	113	59	In very small stool worms all large.
10					No albumin in urine, much mucin, and one hyaline cast.
13	Moderate	2.0	43		Small stool, all large worms.
20	None	2.0	5		
27	do	2.0	4		
30				98	
Oct. 3	None	2.0			

Case, 4934; age, 7; sex, male; grade, intense; Blaud's pills used; anthelmintic, betanaphthol; total days, 37; total rise Hb., 58 per cent; total uncinariæ expelled, 352.

Sept. 24	Many	2.0	339	37	
Oct. 1	Moderate	2.0	2		
11	None	2.0	8		
19					Diarrhea.
20				86	
23	Few	2.0	2		Diarrhea had ceased.
29				95	
30	None	2.0	1		

Series of 30 cases of uncinariasis treated by betanapthol—Continued.

Case, 5808; age, 26; sex, female; grade, benign; no iron used; anthelmintic, betanaphthol; total uncinariæ expelled, 118.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 31	Moderate	2.0	84	118	
Nov. 1			12		Twelve worms expelled 18 hours after last dose.
8	Few	2.0	9		
15	Moderate	2.0	7		
22	None	2.0	3	120	
29	do	2.0			

Case, 5533; age, 35; sex, male; grade, intense; lactate of iron used; anthelmintic, betanaphthol; total days, 60; total rise Hb., 63 per cent; total uncinariæ expelled, 946.

Oct. 18	Some	2.0	708		
20				22	
24	Moderate	2.0	233		
29				39	Severe diarrhea.
Nov. 12				35	
20				45	Diarrhea ceased.
Dec. 9				85	
16	None	2.0	5		

Case, 5826; age, 11; sex, male; grade, intense; no iron used; anthelmintic, betanaphthol; total days, 23; total rise Hb., 34 per cent; total uncinariæ expelled, 152.

Nov. 1	Many	2.0	9	16	
2			85		Twenty hours after last dose.
10	Many	2.0	58		
12				25	
17	Many	2.0			
23				50	

Case, 5537; age, 16; sex, male; grade, medium; reduced iron used; anthelmintic, betanaphthol; total days, 56; total rise Hb., 61 per cent; total uncinariæ expelled, 1,195.

Oct. 18	Many	2.0	693	44	
24	Moderate	2.0	108	50	
31	do	2.0	182		
Nov. 7	do	2.0	37	50	
12				58	
14	Moderate	2.0	68		
22	do	2.0	22	85	
29	do	2.0	25		
Dec. 5	do	2.0	60	105	
12	Few	2.0			

Case, 5609; age, 30; sex, male; grade, intense; arsenic, $\frac{1}{65}$ gr. every 3 hours; anthelmintic, betanaphthol; total days, 38; total rise Hb., 13 per cent; total uncinariæ expelled, 932.

Oct. 18	Many	2.0	278	35	
25	Moderate	2.0	372		
29				35	
Nov. 1	Moderate	2.0	100		
5				29	
8	Moderate	2.0	185		
12				37	
15	Moderate	2.0	85		
21	do	2.0	12		
24				48	

Series of 30 cases of uncinariasis treated by betanaphtol—Continued.

Case, 5626; age, 15; sex, female; grade, intense; no iron used; anthelmintic, betanaphthol; total days, 31; total rise Hb., 29 per cent; total uncinariæ expelled, 725.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 23	Moderate	2.0	661	27	Last dose of betanaphthol at 7 a. m. Large movement at 8.30 a. m.; no worms expelled, but at 10 a. m. in a small movement she expelled 400. At 12 noon expelled 261.
25					Expelled 1 male uncinaria in stage of fatty degeneration.
29	Moderate	2.0	62	36	
31					Diarrhea.
Nov. 5				55	
7	Few	2.0	2		Diarrhea has ceased.
12				56	

Case, 5809; age, 8; sex, male; grade, benign; no iron used; anthelmintic, betanaphthol; total uncinariæ expelled, 159.

Nov. 1	Moderate	1.0	97	97	
8	do	1.0	9		
12				85	
16	Moderate	1.0	2		
22	do	1.0	18	113	
29	do	1.0	4		
Dec. 6	do	1.0	15		
13	Few	1.0	14		

Series of 40 cases of uncinariasis treated by thymol.

Case, 6077; sex, male; age, 18; grade, intense; thymol anthelmintic; Blaud's pills used; complication, tertian benign malaria; total number days, 54; total rise Hb., 54 per cent; total number uncinariæ expelled, 776.

Nov. 23	Many	1.0	114	40	
29				42	
30	Many	1.0	245		
Dec. 6				64	
7	Many	1.0	156		
13				70	
14	Moderate	1.0	29		
20	Few	1.0	189		
23				80	
27	Few	1.0	43	85	
Jan. 15	Moderate	1.0		94	

Case, 4287; sex, male; age, —; grade, very intense; male fern and thymol anthelmintics; Blaud's pills used; complication, none; prominent symptoms, intense pallor, general anasarca, great prostration; all usual symptoms marked; total number days, 47; total rise Hb., 67; total number uncinariæ expelled 1,122.

Sept. 23	Many	6.0	4	12	Male fern used this time.
29	Moderate	6.0			Do.
Oct. 2	Many	8.0	2	19	Male fern used this time.
4					Joint pains severe.
9	Many	4.0	919		Edema of face disappeared; thymol used this time; 8 trichocephali also expelled.
16	Moderate	4.0	185	41	Thymol used.
22	None	4.0	15	49	Thymol used; also expelled 4 trichocephali.
28	do	4.0	3	58	Thymol used.
Nov. 4	do	4.0		72	Thymol used; also expelled 1 trichocephalus.
8				79	

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 5291; sex, female; age, 15; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 37; total rise Hb., 70 per cent; total uncinariæ expelled, 327.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 9	Many	3.0	287	22	
16	Few	3.0	36	40	Also expelled 1 ascaris.
24	do	3.0	4	46	
31	None	3.0		72	
Nov. 5					Severe diarrhea with fever.
14					Diarrhea ceased; temperature normal.
15	None	2.0		84	
21				92	

Case, 5287; sex, male; age, 27; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 48; total rise Hb., 51 per cent; total uncinariæ expelled, 1,979.

Oct. 10	Many	4.0	1,223	14	
17	Moderate	4.0	492	20	
24	Few	4.0	230	29	
Nov. 1	do	4.0	11	35	
7	Moderate	4.0	20	46	
14	None	4.0	3	50	
21	do	4.0		50	
27				65	

Case, 3722; sex, male; age, 22; grade, medium; thymol anthelmintic, Blaud's pills used; total days, 27; total rise Hb., 36 per cent; total uncinariæ expelled, 1,367.

Aug. 1	Moderate	4.0	1,273	58	Much albumin and many casts in urine before treatment began.
9	None	4.0	83	69	
17	do	4.0	11		
20				98	
23	None	4.0		94	
27					Fever and dysentery with blood and mucus.

Case, 4290; sex, male; age, 40; grade, intense; thymol anthelmintic; Blaud's pills used; total days, 51; total rise Hb., 79 per cent; total uncinariæ expelled, 1,361.

Sept. 13	Moderate	4.0	1,237	16	Uncinariæ were expelled the 15th, 24 hours after; also 4 ascarides.
20	do	4.0	77		
27	None	4.0	26	28	
Oct. 1				38	
4	None	4.0	13		
11	do	4.0	3		
18	do	4.0	4		
25	do	4.0	1	64	
Nov. 2	do	4.0		95	

Case, 5991; sex, male; age, 25; grade, very intense; anthelmintics, male fern and thymol; iron, arsenic, and strychnine used; total days, 36; total rise Hb, 19 per cent; total number uncinariæ expelled, 4,395.

Nov. 22	Many	2.5		25	Trace albumin and casts in urine before treatment; male fern used this time.
23					Eyelids puffy.
29	Moderate	4.0	2	23	Male fern used this time.
Dec. 6	do	3.0	3,686	22	Thymol used this time.
12	do	3.0	480	33	Anasarca face; thymol used this time.
20	Few	3.0	218		
22				40	
27	None	3.0		44	

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 5158; sex, male; age, 17; grade, benign; anthelmintic, thymol; Blaud's pills used; complication, hystero-epilepsy; total uncinariæ expelled, 1,007.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 4	Many	3.0	49		Hystero-epilepsy.
11	Moderate	3.0	775		
18	do	3.0	119		Expelled 1 tricocephalus.
25	Few	3.0	93		
26			6		
Nov. 1	Few	3.0	13		Expelled 4 tricocephali.
8	None	3.0	2		
15	Moderate	3.0	17		
22	None	3.0	3		
29	do	3.0			Trace albumin in urine; no casts.

Case, 5188; age, 32; sex, male; grade, very intense; anthelmintic, thymol; Blaud's pills used; complication, can not count fingers at distance of 18 inches; total days, 50; total rise Hb, 49 per cent; total uncinariæ expelled, 3,493.

Oct. 8	Many	4.0	3,101	32	Can not count fingers at distance of 18 to 20 inches. No cataract.
15	Moderate	4.0	203	30	
22	do	4.0	183		
29	Few	4.0	6	35	
Nov. 5	None	4.0		40	
12	do			53	
26				81	Eyesight unimproved.

Case, 4505; sex, female; age, 40; grade, very intense; anthelmintic, thymol; Blaud's pills used; Nov. 18 to 24, had a cataleptic attack, preceded by "epilepsy;" hysteria major frequently; total days, 56; total rise Hb, 51 per cent; total uncinariæ expelled, 1,167.

Sept. 20	Many	3.0	719	18	
27					Severe diarrhea.
Oct. 4	Moderate	3.0	83	50	Diarrhea stopped.
7					Severe diarrhea and prostration.
Nov. 8	Many	3.0	346		
12				69	No diarrhea.
15		3.0	19		Nov. 18, had an attack, apparently epileptic, foaming and bleeding at mouth, biting tongue, pupils dilated, unconscious; history of previous attacks, scars on tongue; by night lapsed into semiconscious, hysteric state. Nov. 19, lies semiconscious, moves and sometimes talks incoherently; becomes worse on being noticed; screams at night. Nov. 20, same; will not swallow; slight catalepsy, which can be overcome by gentle, steady force; eyes staring, but covertly notices what goes on; continual slight grinding of teeth. Nov. 22, talks rationally; is cured.

Case, 6058; age, 15; sex, male; grade, very benign; anthelmintic, thymol; no iron given; prominent symptoms are weariness and pains in chest and legs; total uncinariæ expelled, 574.

Nov. 23	Moderate	4.0	574	120	
30	None	4.0			
Dec. 8	do	4.0			

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 3985; age, 52; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total uncinariæ expelled, 551.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Sept. 7	Moderate	4.0	215	18	No albumin in urine.
14	do	4.0	212		
21	Few	4.0	62		
24					Facial neuralgia.
28	Moderate	4.0	41		
Oct. 16	None	4.0	21		
31	do	4.0			

Case, 3921; age, 28; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 76; total rise Hb, 100 per cent; total uncinariæ expelled, 2,073.

Sept. 5	Moderate	3.0	1,404	20	No albumin in urine.
13	Few	3.0	517		
20	do	3.0	96		
27	do	3.0	36		
Oct. 5	None	3.0	18		
12	do	3.0	2		
20	do	3.0		120	

Case, 5333; age, 45; sex, male; grade, medium; anthelmintic, thymol; Blaud's pills; total days, 21; total rise Hb, 45 per cent; total uncinariæ expelled, 959.

Oct. 10	Moderate	3.0	884	35	No albumin in urine.
13					Severe diarrhea.
18	Moderate	4.0	58	55	Diarrhea has ceased.
21					Albumin in urine, no casts.
24	Moderate	4.0	17		
29				68	
30	None	4.0		80	

Case, 5363; age, 12; sex, male; grade, very intense; anthelmintic, thymol; Blaud's pills; total days, 36; total rise Hb, 105 per cent; total uncinariæ expelled, 1,021.

Oct. 13	Many	2.0	489	15	No albumin in urine.
19	Moderate	2.0	111	31	
24					Diarrhea.
26	Moderate	2.0	287	45	Diarrhea ceased.
Nov. 2	do	2.0	14	60	
10	do	2.0	18	90	
17	None	2.0		120	

Case, 5508; age, 18; sex, male; grade, intense; anthelmintic; thymol; Blaud's pills used; total days, 32; total rise Hb., 65 per cent; total uncinariæ expelled, 1,007.

Oct. 16	Moderate	3.0	704	35	
23	do	3.0	286	60	
29	do	3.0	8	62	
Nov. 4	None	3.0	7	70	Expelled 2 tricocephali.
12	do	3.0	2		
16				100	
17	None	3.0			

Case, 5509; age, 18; sex, male; grade, intense; anthelmintic; thymol; Blaud's pills used; total days, 31; total rise Hb., 92 per cent; total uncinariæ expelled, 2,015.

Oct. 15	Moderate	2.0	1,068	28	One tricocephalus.
22	do	2.0	866	37	No albumin in urine.
28	do	2.0	40	70	
Nov. 3	Few	2.0	36	90	
8	None	2.0	2	95	One tricocephalus.
15	do	2.0	3	120	

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 5545; age, 30; sex, male; grade, very intense; anthelmintic; thymol; Blaud's pills used; total days, 31; total rise Hb., 47 per cent; total uncinariæ expelled, 1,871.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 17	Many	4.0	1,610	35	Albumin in urine before treatment.
21					Diarrhea.
28	Moderate	4.0	252	40	Diarrhea has ceased.
Nov. 5	Few	3.0	8	63	
11	do	3.0	1	64	
17	None	3.0		82	

Case, 5550; age, 8; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 30; total rise Hb., 90 per cent; total uncinariæ expelled, 465.

Oct. 17	Many	1.0	281	20	Albumin in urine before treatment.
24	Moderate	1.0	142	52	
29	Few	1.0	25	80	
Nov. 5	Moderate	1.0	7	92	
11	Few	1.0	5	100	
16	do	1.0	5	110	

Case, 5642; age, 20; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 43; total rise Hb., 110 per cent; total uncinariæ expelled, 544.

Oct. 22	Moderate	3.0	236	10	Albumin in urine before treatment.
28	do	3.0	107	18	
Nov. 3	do	3.0	105	32	
9	Few	3.0	72	54	
15	do	3.0	22	74	
21	do	3.0	2	92	
27	do	3.0		110	
Dec. 3	None	3.0		120	

Case, 3203; age, 29; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 50; total rise Hb., 72 per cent; total uncinariæ expelled, 490.

Aug. 17	Moderate	4.0	358	27	
25					Diarrhea.
27					Diarrhea stopped.
28	Moderate	4.0	90		
Sept. 5	None	4.0	41		
9					Temperature, 40.5.
11					Diarrhea; temperature normal.
16	None	4.0			
20				70	
24				92	
26	None	4.0	1		Albumin and uric acid.
Oct. 1				99	
3	None	4.0			Albumin trace; no casts.

Case, 5737; age, 58; sex, male; grade, medium; anthelmintic, thymol; total days, 22; total rise Hb., 34 per cent; total uncinariæ expelled, 908.

Oct. 27	Moderate	3.0	887	59	
Nov. 3	None	3.0	21	45	
11	Few	4.0		68	
17	None	3.0		93	

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 3784; age, 25; sex, female; grade, intense; anthelmintic, thymol; Blaud's pills used; total days 28; total rise Hb., 60 per cent; total uncinariæ expelled, 881.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Sept. 4	Many	3.0	660	40	Neuralgia.
15	Moderate	4.0	169		Diarrhea for 3 days.
21	Few	4.0	47		Worms very large as compared with first expelled.
27	do	4.0	5		
Oct. 1	None	4.0		100	

Case, 3622; age, 15; sex, female; grade, very intense; anthelmintic, thymol; Blaud's pills used; total days, 33; total rise Hb., 56 per cent; total uncinariæ expelled, 1,352.

Aug. 28	Many	4.0	1,307	39	Many small.
Sept. 5	None	4.0	19		All very large.
9				64	Diarrhea; trace albumin.
13	None	4.0	24		Diarrhea has ceased.
20	do	4.0	2	95	

Case, 4766; age, 30; sex, female; grade, intense; anthelmintics male fern and thymol; Blaud's pills used; total days, 56; total rise Hb., 45 per cent; total uncinariæ expelled, 1,446.

Sept. 22	Moderate	6.0	4	25	Male fern used.
28	Many	6.0			Do.
Oct. 1				21	
8	Many	4.0	1,321		Thymol used.
14	Moderate	4.0	108		Do.
21	Few	4.0	17	43	Do.
29	None	4.0		70	Do.
Nov. 9	do	4.0		70	Do.
16	do	3.0			Do.

Case, 3526; age, 25; sex, female; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 38; total rise Hb., 57 per cent; total uncinariæ expelled, 424.

Aug. 25	Moderate	4.0	93	37	
Sept. 1	do	4.0	205		
8	Few	4.0	85		All worms very large.
15	Moderate	4.0	31		
20					Diarrhea.
22	Few	4.0	10		Diarrhea ceased; only one ovum found in specimen.
28	None	4.0			
Oct. 1				94	

Case, 5022; age, 25; sex, female; grade, medium; anthelmintic, thymol; Blaud's pills used; total days, 34; total loss Hb., 3 per cent; total uncinariæ expelled, 847.

Oct. 1	Moderate	4.0	818	64	
9	Few	4.0	17		
14					Diarrhea.
16	None	4.0	12		Diarrhea ceased.
20				38	
26	None	4.0			
29				47	
Nov. 3				61	

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 6087; age, 40; sex, female; grade, intense; anthelmintic, thymol; no iron used; total days, 28; total rise Hb., 28 per cent; total uncinariæ expelled, 1,148.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Nov. 19	Moderate	4.0	918	39	
25	do	4.0	174		
29					Diarrhea.
Dec. 3	Few	4.0	44	68	Diarrhea has ceased.
11	do	4.0	12		
17	None	4.0			

Case, 6049; age, 22; sex, male; grade, medium; anthelmintic, thymol; no iron used; total days, 14; total rise Hb., 20 per cent; total uncinariæ expelled, 236.

Nov. 22	Moderate	4.0	182	89	Some fever, disappearing in two days.
28	do	4.0	51		
Dec. 3				109	
5	None	4.0	3		
12	do	4.0			

Case, 6032; age, 25; sex, male; grade, benign; anthelmintic, thymol; no iron used; total days, 15; total rise Hb., 32 per cent; total uncinariæ expelled, 336.

Nov. 19	Moderate	4.0	309	88	
26	None	4.0	25		
Dec. 3	do	4.0	2	120	

Case, 3291; age, 40; sex, male; grade, medium; anthelmintic, thymol; Blaud's pills used; complication, estivo-autumnal malarial fever; quinine administered; total days, 24; total rise Hb., 39 per cent; total uncinariæ expelled, 326.

Aug. 14	Few	4.0	285	73	After thymol urine full of hyaline, granular and epithelial casts. Much albumin and abundant urates and oxalate calcium crystals.
17					Chill and fever. Blood showed many crescents estivo-autumnal fever.
23	Few	4.0	36	98	Malaria controlled.
31	None	4.0	1		One expelled was male.
Sept. 1					Very severe diarrhea.
4					Diarrhea controlled.
6	None	2.0	4	112	Betanaphthol used. All four expelled were males.

Case, 5990; age, 54; sex, male; grade, intense; anthelmintic, thymol; no iron used; total uncinariæ expelled, 716.

Nov. 17	Moderate	2.0	481	40	
25	do	2.0	216		
Dec. 3	Few	2.0	12	50	
10	None	2.0	7		
17	do	2.0			

Case, 4574; age, 30; sex, male; grade, very intense; anthelmintic, thymol; Blaud's pills used; total days, 30; total rise Hb., 6 per cent; total uncinariæ expelled, 1,136.

Sept. 21	Few	4.0	1,070		This case had only a few ova of uncinaria in the stools.
27	do	4.0	61	29	
Oct. 4	None	4.0			
12	do	4.0	2		Also one tricocephalus.
17	do	4.0	3		
20				35	

Series of 40 cases of uncinariasis treated by thymol—Continued.

Case, 5124; age, 25; sex, female; grade, very intense; anthelmintic, thymol; arsenic, $\frac{1}{100}$ grain used; total days, 34; total rise Hb., 38 per cent; total uncinariæ expelled, 623.

Date.	Ova uncinariæ.	Dose in grams.	Uncinariæ expelled after anthelmintic.	Hemoglobin.	Remarks.
				Per cent.	
Oct. 4	Many	4.0	541	19	
11	None	4.0	57	.....	
18	Few	4.0	23	37	
21	.....	.....	.....	.....	Arsenic raised to $\frac{1}{50}$ grain.
26	None	4.0	2	39	
Nov. 2	....do	4.0	.....	.....	
6	.....	.....	.....	47	

Case, 4626; age, 18; sex, male; grade, medium; anthelmintic, thymol; Blaud's pills and quinine used; total days, 10; total rise Hb., 8 per cent; total uncinariæ expelled, 249.

Sept. 23	Moderate	4.0	234	83	Crescents in blood. Chill and fever.
Oct. 2	None	4.0	15	91	All uncinariæ very large.

Case, 4286; age, 22; sex, male; grade, intense; anthelmintic, thymol; complication, tertian benign malarial fever; Blaud's pills and quinine used; total days, 22; total rise Hb., 42 per cent; total uncinariæ expelled, 1,160.

Sept. 9	Many	4.0	1,149	50	Many uncinariæ expelled are exceedingly small. Tertian benign malarial parasites found in blood. Chill and fever.
16	Few	4.0	10	.....	Malaria controlled.
23	....do	4.0	.....	.....	
30	....do	4.0	1	92	

Case, 3934; age, 25; sex, male; grade, medium; anthelmintic, thymol; Blaud's pills used; total days, 53; total rise Hb., 47 per cent; total uncinariæ expelled, 1,110.

Sept. 5	Moderate	4.0	670	47	
13	....do	4.0	372	.....	
20	None	4.0	46	.....	Neuralgia.
27	....do	4.0	15	82	
Oct. 4	....do	4.0	7	.....	
11	....do	4.0	.....	86	
27	.....	.....	.....	94	

Case, 6067; age, 38; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 22; total rise Hb., 2 per cent; total uncinariæ expelled, 96.

Oct. 24	Moderate	2.0	77	40	
Dec. 1	Few	2.0	19	42	
8	None	2.0	.....	45	Diarrhea.
15	....do	2.0	.....	42	Do.

Case, 5257; age, 18; sex, male; grade, intense; anthelmintic, thymol; Blaud's pills used; total days, 24; total rise Hb., 32 per cent; total uncinariæ expelled, 2,316.

Oct. 8	Many	4.0	2,264	44	
15	Moderate	3.0	39	55	
22	Few	3.0	13	.....	
29	.....	.....	.....	76	
31	.....	.....	.....	.....	Diarrhea.

Case, 5172; age, 24; sex, male; grade, very intense; anthelmintic, thymol; reduced iron used; total days, 19; total rise Hb., 18 per cent; total uncinariæ expelled, 1,384.

Oct. 5	Many	4.0	1,215	21	
15	Moderate	4.0	150	.....	
20	.....	.....	.....	39	
23	None	4.0	19	.....	

URINE GROUP.

These 24 cases were studied solely for the purpose of determining the effect of the drug upon the urine. In the course of this investigation it cropped out that albumin and casts were frequent in persons infected who had not only not had the specific drugs, which we believe an inspection of these histories will demonstrate are at least renal irritants, but in persons whose anemia was not marked.

The points investigated were: (1) Albumin. (2) Balsamic resins. (3) Diazo-reaction. (4) Peptones. (5) Urobilin. (6) The sediment, by sedimentation of several hours in test glass. (7) The specific gravity, reaction, and color. (8) Irregularly, indican.

Our method was unvarying for each case; the urine was examined completely, as per above, the night before and the morning of the administration of the anthelmintic, i. e., twice before the dose; and the afternoon of the day in which the drug was given and the next morning, i. e., twice after the anthelmintic. In the tabled cases to follow, it will be noticed that no note is made of the balsamic resins, the diazo-reaction, the peptones, urobilin, indican, or reaction or color.

Balsamic resins were not found; the diazo-reaction was never found before either drug and never after thymol, *but it was invaryingly found after betanaphthol*, always the afternoon of the day the drug was given and rarely the next morning. In other words, the presence of the diazo-reaction of betanaphthol was fleeting. The reaction was intense and was never doubtful.

Peptones were demonstrated very frequently, but their presence was so exceedingly irregular that no good purpose would be subserved in tabling our results; the same may be said of urobilin, which at times was very prominent.

It is regrettable that indican was not systematically sought, but was always found when the test was applied.

The reaction was practically always decidedly acid.

The color after thymol, at times (and far less frequently than we expected), became an olive green on standing. There was no change in color after the administration of betanaphthol. Before the administration of either drug the color was found to be light, rather than dark, and polyuria was a marked feature.

There were three tests for albumin applied:

1. Boiling with the addition of a couple of drops of acetic acid thereafter. This was the test that brought out the faint trace of albumin not found many times by the other tests.
2. The potassium ferro-cyanide test.
3. The c. p. nitric acid ring test. This test was often confused by the large amount of urates found after the administration of the anthelmintics.

The cases referred under the hemoglobin readings are: 5087, 5810, 5804, 5827, 5803, 5852, 5785, 6076, and 5934.

Cases 5802, 5809, 5808, 5826, 5991, 5172, 6067, 6087, 5990, 6032, 6049, 6058, 6077 are the same cases as those found with the same number under the headings "thymol" and "betanaphthol" groups.

The abbreviations used are: "Sl. tr." and "Tr." for slight trace and trace; "F." for few, "Mod." for moderate, "M." for much or many, "P." for present.

Summary.	Per cent of hemoglobin.	Dose in grams.	Before and after each dose.	No. uncin. expelled.	Sp. gr. urine.	Albumin.	Casts. Hyaline.	Casts. Granular.	Casts. Fatty.	Casts. Epithelial.	Crystals. Cal. oxalate.	Crystals. Uric acid.	Mucin.	Leucocytes.
Case 5087. Grade, moderate; age, 28; sex, female; betanaphthol given; no iron used; gastric symptoms prominent; albumin appeared under treatment; total worms expelled, 497.	35	2	Before 1st			None.								
			After 1st	325	1.032	None.	F.	F.					P.	
		2	Before 2d		1.027	Sl. tr.								
			After 2d	128		Sl. tr.								
	96	2	Before 3d		1.015	Sl. tr.	F.	F.	F.					
			After 3d	1	1.019	Sl. tr.								
		2	Before 4th		1.017	Sl. tr.								
			After 4th	14	1.028	Sl. tr.	F.						P.	
		2	Before 5th		1.011	Sl. tr.								
			After 5th	17	1.017	Sl. tr.								
		2	Before 6th		1.007	Sl. tr.								
			After 6th	12	1.014	Sl. tr.								
		2	Before 7th		1.018	Sl. tr.								
			After 7th		1.021	Sl. tr.							P.	
Case 5802. Grade, intense; age, 18; sex, male; betanaphthol given; no iron used; albumin present and increased in amount; total worms expelled, 1,315.	18	2	Before 1st		1.006	Sl. tr.	F.	F.						Mod.
			After 1st	432	1.018	None.	F.	F.						Few.
	17	2	Before 2d		1.008	Sl. tr.	F.	F.		F.				Few.
			After 2d	494	1.010	Sl. tr.	F.	F.		F.				Few.
		2	Before 3d		1.007	Sl. tr.	F.	F.		F.				Few.
	25		After 3d	233	1.010	Sl. tr.	F.	F.					P.	
	31	2	Before 4th		1.008	Sl. tr.	F.	F.					P.	
			After 4th	76	1.004	Sl. tr.	F.	F.					P.	
	28	2	Before 5th		1.008	Sl. tr.								
			After 5th	70	1.017	Sl. tr.	F.			F.	P.		P.	Mod.
	45	2	Before 6th		1.009	Mod.	F.	F.		F.			P.	Mod.
			After 6th	10	1.016	M.	F.		F.	F.				Mod.
			5 days later			M.	M.	M.		M.			P.	Mod.
Case 5810. Grade, very benign; age, 5; sex, female; betanaphthol; albumin appeared under treatment; total worms expelled, 10 (?).	110	1	Before 1st		1.015	None.								
			After 1st	10	1.030	None.								
		1	Before 2d		1.014	None.								
			After 2d	(?)	1.013	None.								
	112	1	Before 3d		1.006	None.								
			After 3d		1.010	Sl. tr.								M.
		1	Before 4th		1.006	Sl. tr.								M.
	120		After 4th		1.005	Sl. tr.								
Case 5804. Grade, intense; age, 17; sex, male; betanaphthol; no iron given; albumin present but did not increase in amount; the prominent symptoms were those of the circulatory and nervous systems: total worms expelled, 908.	27	2	Before 1st		1.013	Sl. tr.	M.	M.						
			After 1st	112	1.018	Sl. tr.	F.	F.						M.
	24	2	Before 2d		1.011	Sl. tr.	F.	F.						
			After 2d	275	1.012	Sl. tr.	F.	F.						
	31	2	Before 3d		1.013	Sl. tr.	F.	F.						
			After 3d	165	1.015	Sl. tr.	F.	F.						
		2	Before 4th		1.010	Sl. tr.	F.	F.	F.					
	30		After 4th	118	1.015	Sl. tr.	F.	F.	F.				P.	
		2	Before 5th		1.008	Sl. tr.	M.	M.		M.				M.
			After 5th	19	1.025	Sl. tr.	F.	F.		F.				M.
	35	2	Before 6th		1.015	Sl. tr.		F.		F.				
			After 6th	42	1.020	Sl. tr.								
		2	Before 7th		1.010	Sl. tr.	M.	M.						
			After 7th	177	1.019	Sl. tr.	F.							
	50	2	Before 8th		1.013	Sl. tr.								
			After 8th		1.025	Sl. tr.	F.	F.						
Case 5827. Grade, intense; age, 9; sex, male; betanaphthol; no iron given; albumin present and increased under treatment but subsided rapidly; prominent symptoms those of circulatory system; total worms expelled, 268.	44	2	Before 1st		1.018	Sl. tr.	F.							
			After 1st	192	1.030	Sl. tr.	F.						P.	
		2	Before 2d		1.020	Tr.	F.	F.				M.	P.	
	42		After 2d	15	1.037	Mod.	F.	F.					P.	
		2	Before 3d		1.037	Mod.	F.				M.		P.	
			After 3d	61	1.035	M.	F.	F.					P.	
	87	2	Before 4th		1.007	Sl. tr.							P.	
			After 4th	(?)	1.039	Mod.	F.	F.					P.	
Case 5826. Grade, intense; age, 11; sex, male; betanaphthol; no iron given; albumin present and increased a good deal under treatment; total worms expelled, 94.	16	2	Before 1st			Sl. tr.	F.							
			After 1st	94	1.014	Sl. tr.								
		2	Before 2d		1.007	Sl. tr.	F.	F.						
			After 2d		1.015	Sl. tr.	F.							
	25	2	Before 3d		1.009	Tr.	F.	F.	F.					
			After 3d		1.026	Tr.	F.	F.					P.	F.
		2	Before 4th		1.017	M.	F.	F.						
	50		After 4th		1.029	M.	M.	M.					P.	

Summary.	Per cent of hemoglobin.	Dose in grams.	Before and after each dose.	No. uncin. expelled.	Sp. gr. urine.	Albumin.	Casts. Hyaline.	Casts. Granular.	Casts. Fatty.	Casts. Epithelial.	Crystals. Cal. oxalate.	Crystals. Uric acid.	Mucin.	Leucocytes.
Case 5803. Grade, moderate; age, 45; sex, female; betanaphthol; no iron given; albumin present but did not increase under treatment; total worms expelled, 28.	65	2	Before 1st		1.016	M.	F.	F.	F.					
			After 1st	10	1.025	Tr.								F.
		2	Before 2d		1.012	Sl. tr.	F.							
	12		After 2d	12	1.012	None.								
	65	2	Before 3d		1.010	Sl. tr.	F.							
			After 3d	4	1.020	Sl. tr.	M.	M.						
		2	Before 4th		1.009	None.	F.	F.						
	58		After 4th	2	1.018	Sl. tr.	F.	F.						
Case 5852. Grade, intense; age, 26; sex, male; betanaphthol; after the first dose there were 242 uncinaria expelled in the second 24 hours; albumin present and slightly increased in amount under treatment; total worms expelled, 2,749.	18	2	Before 1st		1.012	Sl. tr.	F.	F.						
			After 1st	1,630	1.025	Sl. tr.	M.	M.						
		2	Before 2d		1.008	Tr.	F.	F.						
	17		After 2d	810	1.012	Tr.	F.	F.	F.					
		2	Before 3d		1.007	Tr.	F.	F.						
			After 3d	309	1.010	Sl. tr.								
Case, no number. Grade, moderate; age, 10; sex, male; betanaphthol; complication; quartan malaria; albumin present but increased under treatment.		2	Before 1st		1.003	Sl. tr.	M.	M.	M.					
			After 1st		1.011	Mod.	M.	M.						
		2	Before 2d		1.015	Sl. tr.	M.	M.	M.	M.				
			After 2d		1.016	Sl. tr.	M.	M.		M.				
Case 5809. Grade, very benign; sex, male; age, 8; betanaphthol; albumin appeared under treatment; probably mere irritation of kidney; total worms expelled, 159.	97	1	Before 1st		1.020	None.								
			After 1st	97	1.025	Sl. tr.						F.	P.	
		1	Before 2d		1.010	Sl. tr.								
			After 2d	9	1.021	None.								
	85	1	Before 3d		1.014	None.								
			After 3d	2	1.012	Sl. tr.								
		1	Before 4th		1.020	Sl. tr.								
			After 4th	18	1.025	Sl. tr.								
	113	1	Before 5th		1.009	Sl. tr.								
			After 5th	4	1.007	Sl. tr.								
		1	Before 6th		1.009	None.								
			After 6th	15	1.025	Sl. tr.								
		1	Before 7th		1.007	Tr.								
			After 7th	14	1.009	Sl. tr.								
			6 days later		1.010	None.								
Case, no number. Sex, female; age, 6; betanaphthol; has no uncinaria; expelled 415 oxyurides after first dose; 13 after second dose; none after third dose; albumin appeared under treatment.		1	Before 1st			None.								
			After 1st		1.015	Sl. tr.								
		1	Before 2d		1.024	Sl. tr.					P.			
			After 2d		1.015	Sl. tr.								
		1	Before 3d		1.010	Sl. tr.								
			After 3d		1.012	Sl. tr.								
Case 5808. Grade, benign; sex, female; age, 26; betanaphthol; chief symptom: marked dyspepsia. Albumin did not increase in amount but was present before administration of anthelmintic. Total worms expelled, 115.		2	Before 1st		1.015	Sl. tr.	F.	F.						
	118		After 1st	96	1.036	Tr.	F.	F.						
		2	Before 2d		1.017	Tr.								
			After 2d	9	1.007	Sl. tr.								
	108	2	Before 3d		1.007	None.	F.	F.						
			After 3d	7	1.032	Sl. tr.							P.	Mod.
		2	Before 4th		1.006	Sl. tr.	F.						P.	Mod.
	120		After 4th	3	1.022	Sl. tr.	F.							
		2	Before 5th		1.011	None.					M.		P.	
			After 5th		1.016	Sl. tr.	F.			F.				

Summary.	Per cent of hemoglobin.	Dose in grams.	Before and after each dose.	No. uncin. expelled.	Sq. gr. urine.	Albumin.	Casts. Hyaline.	Casts. Granular.	Casts. Fatty.	Casts. Epithelial.	Crystals. Cal. oxalate.	Crystals. Uric acid.	Mucin.	Leucocytes.
Case 5785. Grade, very intense; age, 17; sex, male; betanaphthol; no iron given; albumin present but increased under treatment; chief symptoms of this case, very marked circulatory, digestive, and nervous; has had diarrhea for three months; total worms expelled, 246.	13	2	Before 1st		1.011	Sl. tr.	M.	M.						
			After 1st	192	1.017	Sl. tr.	M.	M.			M.			
		2	Before 2d		1.012	Tr.	F.							
			After 2d	15	1.020	M.								
	72	2	Before 3d		1.017	M.	M.	M.	F.				P.	
			After 3d	39	1.020	M.	F.	F.	F.				P.	
		2	Before 4th		1.020	Sl. tr.	F.	F.	F.				P.	
	70		After 4th		1.030	Tr.	F.	F.			F.		P.	
		2	Before 5th		1.030	Sl. tr.	F.		F.	F.				
	95		After 5th		1.015	M.	F.	F.	F.				P.	
Case 5991. Grade, very intense; age, 25; sex, male; male fern twice, thymol three times; given iron, quinine, and strychnine in the intervals; albumin present and slightly increased in amount under treatment; total worms expelled, 4,397.	25	2	Before 1st		1.009	Sl. tr.				F.				
			After 1st		1.011	Sl. tr.	F.			F.				F.
	23	4	Before 2d		1.008	Tr.								F.
			After 2d	2	1.011	Tr.	F.			F.			P.	M.
	22	3	Before 3d		1.009	Tr.							P.	F.
			After 3d	3 686	1.012	Mod.	F.	F.		F.			P.	M.
	33	3	Before 4th		1.010	Tr.							P.	
			After 4th	480	1.015	Tr.	F.							
	40	3	Before 5th		1.011	None.							P.	F.
			After 5th	218	1.013	Sl. tr.	F.							F.
	44	3	Before 6th		1.015	Tr.	F.							
			After 6th	11	1.016	Tr.								
Case 5172. Grade, very intense; sex, male; age, 24; thymol; reduced iron given; albumin present and did not increase in amount; total worms expelled, 1,384.	21	4	Before 1st		1.015	Sl. tr.						F.		
			After 1st	1.215	1.023	Sl. tr.	F.	F.						
		4	Before 2d		1.012	Sl. tr.	F.	F.						
	39		After 2d	150	1.022	Sl. tr.	F.							
		4	Before 3d		1.012	None.	F.							
			After 3d	19	1.021	Sl. tr.	F.						P.	
Case 6067. Grade, intense; sex, male; age, 38; thymol; iron given; albumin increased in amount; total worms expelled. 90.	40	2	Before 1st		1.009	Sl. tr.								
			After 1st	77	1.025	Sl. tr.							P.	
	42	2	Before 2d		1.013	Sl. tr.							P.	
			After 2d	19	1.026	Sl. tr.								
	45	2	Before 3d		1.015	Tr.	F.	F.					P.	F.
			After 3d		1.030	Mod.	F.	F.	F.			M.	P.	F.
	42	2	Before 4th		1.013	Tr.	F.	F.					P.	F.
			After 4th		1.025	Tr.	F.	F.					P.	F.
Case 6076. Grade, intense; sex, male; age, 14; thymol; no iron given; albumin present, but increased in amount; total worms expelled, 724.	35	2	Before 1st		1.020	Mod.	F.	F.						Mod.
			After 1st	721	1.023	Mod.	F.	F.						Mod.
		2	Before 2d		1.013	Mod.	F.	F.						M.
	43		After 2d		1.026	M.							P.	M.
		2	Before 3d		1.013	Mod.								M.
	50		After 3d	3	1.017	M.								M.
		2	Before 4th		1.019	M.	F.	F.						
	90		After 4th		1.024	M.	F.	F.						
Case 6087. Grade, intense; sex, female; age, 40; thymol; complication, severe diarrhea; albumin present, but increased in amount; total worms expelled, 1,148.	39	4	Before 1st		1.010	M.	F.	F.					P.	M.
			After 1st	918	1.021	M.								M.
		4	Before 2d		1.008	M.	F.	F.						M.
			After 2d	174	1.025	M.	F.	F.						M.
	68	4	Before 3d		1.008	M.								M.
			After 3d	44	1.025	M.	F.	F.						M.
		4	Before 4th		1.005	Tr.								M.
			After 4th	12	1.030	Mod.								M.
		4	Before 5th		1.008	Tr.								F.
			After 5th		1.025	M.	F.	F.						M.

Summary.	Per cent of hemoglobin.	Dose in grains.	Before and after each dose.	No. uncin. expelled.	Sp. gr. urine.	Albumin.	Casts. Hyaline.	Casts. Granular.	Casts. Fatty.	Casts. Epithelial.	Crystals. Cal. oxalate.	Crystals. Uric acid.	Mucin.	Leucocytes.
Case 5990. Grade, intense; sex, male; age, 54; thymol; no iron given; albumin present and increased temporarily; total worms expelled, 716.	40	2	Before 1st		1.022	Sl. tr.	M.	M.					P.	
			After 1st	481	1.028	Sl. tr.	M.	M.			M.	M.		
		2	Before 2d		1.011	Mod.	M.	M.					P.	
			After 2d	216	1.022	Mod.	F.	F.	F.				P.	
		2	Before 3d		1.017	Mod.	M.	M.						
	50		After 3d	12	1.020	M.	F.	F.					P.	
		2	Before 4th		1.015	Tr.	M.	M.	M.					
			After 4th	7	1.025	Mod.								
		2	Before 5th		1.015	Sl. tr.								
	78		After 5th		1.029	Sl. tr.	M.	M.					P.	
Case 5934. Grade, very intense; sex, male; age, 55; thymol; severe diarrhea in course of treatment; albumin present but did not increase in amount under treatment; total worms expelled, 884.		2	Before 1st			Sl. tr.	M.	M.						
	15		After 1st	501	1.014	Sl. tr.	M.	M.					P.	
		2	Before 2d		1.010	Sl. tr.	M.	M.	M.					
	17		After 2d	243	1.015	Sl. tr.	M.	M.						
		2	Before 3d		1.011	Sl. tr.	M.	M.						
	32		After 3d	140	1.017	Sl. tr.	M.	M.						
Case 6032. Grade, benign; sex, male; age, 25; thymol; no iron given; albumin present but increased in amount under treatment; later fell below what it originally was; total worms expelled, 336.	88	4	Before 1st		1.018	Sl. tr.	F.	F.						
			After 1st	309	1.029	Sl. tr.	F.	F.						
		4	Before 2d		1.018	Sl. tr.		F.	F.				P.	
			After 2d	25	1.030	Mod.	F.	F.	F.				P.	
	120	4	Before 3d		1.018	Tr.	F.							
			After 3d	2	1.026	Sl. tr.	M.	M.	M.					
Case 6049. Grade, moderate; sex, male; age, 22; no iron given; albumin present but not increased in amount under treatment; total worms expelled, 200.	89	4	Before 1st		1.020	Tr.	M.	M.		M.			P.	
			After 1st	182	1.025	Tr.	M.	M.			M.		P.	
		4	Before 2d		1.017	Tr.	M.	M.		M.				
			After 2d	15	1.030	None.	M.	F.		F.	M.		P.	
	109	4	Before 3d		1.004	Sl. tr.	F.	F.	F.					
			After 3d	3	1.025	Sl. tr.	M.	M.	M.				P.	
		4	Before 4th		1.017	None.	F.							
			After 4th		1.018	Sl. tr.	M.	M.						
Case 6058. Grade, benign; sex, male; age, 15; thymol; albumin present but increased in amount under treatment; total worms expelled, 574.			Before 1st		1.015	Sl. tr.	F.							
	120	4	After 1st	574	1.031	Sl. tr.								F.
			Before 2d		1.007	Sl. tr.	F.	F.					P.	
		4	After 2d		1.029	Sl. tr.						M.	P.	F.
			Before 3d		1.010	Tr.							P.	
		4	After 3d		1.032	Mod.							P.	
Case 6077. Grade, intense; sex, male; age, 18; thymol; complication, tertian malaria; iron, quinine, and arsenic; albumin present, but increased in amount; total worms expelled, 776.	40	1	Before 1st		1.012	Sl. tr.	F.							
			After 1st	114	1.029	None.							P.	
	42	1	Before 2d		1.010	Sl. tr.							P.	
			After 2d	245	1.029	Sl. tr.								
	64	1	Before 3d		1.016	Sl. tr.	F.						P.	F.
			After 3d	156	1.036	Sl. tr.	F.							
	70	1	Before 4th		1.007	None.								
			After 4th	29	1.029	None.						M.		
		1	Before 5th		1.014	Tr.	F.						P.	
	80		After 5th	189	1.028	None.	F.							
	85	1	Before 6th		1.015	Tr.							P.	
			After 6th	43	1.009	Mod.							P.	
	94	1	Before 7th		1.014	Tr.		F.					P.	
			After 7th		1.026	Tr.	F.	F.					P.	

SUMMARY OF CASES IN HOSPITAL IN WHOM URINE DATA WAS OBTAINED BUT NOT COMPLETED.[1]

Case 399.—Felipe Moreno, aged 25, male; many ova uncin.; medium case. Pain in pit of stomach, headache, and general debility most prominent symptoms. Admitted to dispensary treatment June 9. Given 3-25 B. N. June 19, severe exacerbation of a chronic dysentery; given astringents and opium pills; also Blaud's pills; few ova uncin. in stools. June 26, some uncin. ova; still dysentery but improved. Given 2 grams B. N. and Blaud's pills, the former without any purge. July 4, still suffering from dysentery. Admitted to hospital. July 5, urine—albumin, hyaline and epithelial casts. Many ova uncin. After urinalysis, 2-20 B. N. July 6, urine—albumen, few hyaline casts, no blood. July 8, 10, and 11, urine—no albumin. July 13, some uncin. ova, 2-20 B. N.; after drug, urine—slight trace albumin. July 14, 15, 16, 17, and 18, urine—no albumin. July 20, 2-20 B. N.; some uncin. ova. July 22, urine—slight trace albumin. July 26, 2-20 B. N.; some uncin. ova. July 28, urine—slight trace albumin. Discharged from hospital much improved. August 3, urine—much albumin. Man red and well save for cramps in legs at times. No uncin. ova, 2-20 B. N. after urinalysis. August 12, no uncin. ova, 2-20 B. N. Cured.

Case 1330.—Francisca Rivera, aged 16, female; great many ova uncin.; very intense case; great pallor, debility, and practically all of the nervous, circulatory, and digestive phenomena of severe case of uncinariasis. Admitted to hospital June 24. Given 3-15 B. N. Blaud's pills used in intervals. June 29, many ova uncin., 2-20 B. N. July 2 and 6, no albumin. July 6, after urinalysis, 2-20 B. N., many uncin. ova. July 8, 10, 11, and 12, no albumin. July 13, some uncin. ova, 2-20 B. N. and two hours after last dose, urine—no albumin. July 15, 16, 17, 18, urine—no albumin. July 19, some uncin. ova. Has severe headache and fever due to acute coryza. No parasites of malaria. July 20, urine—no albumin. Given 0.30 quinine sulphate every three hours to-day. July 21, has suddenly become blind with signs of congestion of the brain. Temperature 100. Stopped quinine and gave 0.32 calomel. Milk diet. July 22, urine—albumin. July 24, most of her sight has returned. Much better. No fever. July 27, urine—no albumin. After urinalysis given 2-20 B. N., had few ova uncin. July 28, urine—no albumin. July 31, urine—albumin, no casts but many erythrocytes, leucocytes and cellular elements attendant upon admixture of menstrual fluid with urine. August 1, has a very heavy "cold." Urine—albumin. Menstruation ceased. August 2, few uncin. ova, 2-20 B. N. August 3, urine—albumin, very few hyaline and granular casts. August 4, menstruation has returned but is scanty, Another sudden attack of blindness similar to the first. August 6, blindness has about disappeared. Urine—albumin. August 7 and 8, urine—albumin. August 9, urine—no albumin. No uncin. ova, 2-20 B. N. August 13, no uncin. ova. Discharged the hospital in excellent color and without symptoms of disease. Says she still suffers slightly from obscure vision. Cured of uncinariasis.

Case 1790.—Antonio Davila, aged 25, male; great many ova uncin.; very intense case; all symptoms of intense case uncinariasis save edema. Also malaria. July 5, examination blood revealed large number plasmodia. Hb. 43 per cent. Given 0.20 calomel and in two hours began quinine sulphate, 0.32, every three hours, which was continued for three days. No further symptoms of malaria manifested themselves thereafter. July 5, 6, 7, and 8, urine—no albumin. July 9, 2-10 B. N. Blaud's pills used in intervals. Urine—two hours after first dose of B. N., albumin and hyaline and granular casts. July 10, 11, 12, 14, 15, and 16, urine—no albumin. July 17, many ova uncin., 2-20 B. N. Urine—no albumin after this dose. July 18, urine—no albumin. July 20 and 22, urine—albumin. July 24, some ova uncin., 2-20 B. N. Urine—after his dose slight trace albumin. July 26, discharged hospital greatly improved. August 1, urine—before dose, very slight trace albumin. Very few uncin. ova, 2-20 B. N. August 8, urine—before dose, no albumin. No uncin. ova, 2-20 B. N. August 15, few uncin, ova, 4-20 thymol. August 22, few uncin. ova, 4-20 thymol.. August 29, urine—no albumin. No uncin. ova, 4-20 thymol. September 7, few uncin. ova, 4-20 thymol. September 14, urine—no albumin. No uncin. ova, 4-20 thymol. September 22, no uncin. ova, 2-20 B. N. November 25, urine—not a trace of albumin by any test. Man cured completely and has excellent color.

Case 13.—Cruz Ortiz, aged 25, male; few uncinaria (one ovum to every 4 or 5 microscopic fields); medium case; prominent symptoms are: Marked paresthesia of feet and legs and cramps in legs, debility, dizziness and pain in region of liver and in pit of stomach. Admitted to dispensary June 2 and given 3-30 B. N. Hb., 58 per cent. June 9, very few uncin. ova, 3-25 B. N. Hb., 62 per cent. June 16, very few uncin.

[1] Abbreviations as per report of 1904, Appendix.

ova, 3-25 B. N. Hb., 61 per cent. June 23, 3-25 B. N., very few uncin. ova. Hb., 75 per cent. June 29, last night suddenly taken with severe vomiting and purging with cramps in the legs and suppression of urine. He has had these attacks before; the first was in January. He was given calomel 0.065 every hour for four doses and brandy hypodermically every two hours. To-day admitted to hospital. Has vomited every thing he took all day and is in a state of collapse. June 30, condition the same. Vomited every thing he took all day. Passed a small quantity of smoky urine for first time in 48 hours. Urine—smoky and scanty, loaded with albumin and hyaline, granular, amyloid and epithelial casts, no blood, some renal cells and much bile pigment. Flaxseed meal poultices applied to the kidneys and at night leaves of digitalis added to same; also given 0.032 calomel every hour to eight doses. The hypodermic administration of brandy was continued. Pulse slow (50 to 60 to the minute) and weak. Is profoundly depressed. Gravely ill. July 1, is urinating more freely and urine is less smoky. There is little sediment. Urine—albumin; hyaline, granular and fatty casts. Continued to poultice all day with digitalis leaves until 4.30 p. m. Effect on pulse excellent, which is slow and full. Gave one-fiftieth grain of trinitrin every three hours to four doses, then prescribed spirits of nitrous ether 20 drops, and solution of acetate of ammonia, 40 drops, every three hours. Given milk diet. Man is better. July 2, given only the sweet spirits of nitre and acetate of potash as per above. Abundant and clear urine. July 3, urine—has passed 2,000 c. c. urine in last 24 hours. Some albumin. Feels well and hungry but retained on milk diet and given nitre and acetate of potash as per above every four hours. July 4, has been placed on general diet as he is remarkably improved. Urine—absolutely no albumin. July 5, urine—no albumin whatsoever but a few hyaline and granular casts. States that he is subject to these attacks with suppression of urine, vomiting, pain in stomach, fever, headache and cramps in legs. Had an attack of this nature in January last from which he nearly died. That was his first attack but he has had one more previous to this one. Examination of feces this date revealed many ova of uncin. July 6, Blaud's pills were begun to day and continued in the intervals between specific medication. Urine—no albumin. July 7, Hb. 77 per cent. July 8, 10, 11, and 12, urine—no albumin. July 13, many ova uncinaria, 1-20 thymol. Urine—after dose, no albumin. July 14, 15, 16, 17, and 18, urine—no albumin. July 20, some uncin. ova, 1-20 thymol. Urine—after dose, no albumin. July 22, urine—no albumin July 23, pain in back over site of kidneys and fever. July 25, same; urine—no albumin. July 26, urine—no albumin. Hb., 98 per cent. Man very much improved. Seems well. July 27, some uncin. ova, 4-20 thymol. Bloody stool after taking the thymol. Urine—absolutely no albumin but a heavy precipitate of salmon color, containing great abundance of uric acid crystals and many hyaline and granular casts. Given nitre and acetate of potash as before every three hours. July 28, urine—completely clear and without sediment; no albumin. Feels perfectly well and was discharged from hospital. Given the following to take for two weeks: Boric acid, 0.130; potas. bicarb 0.130; extract. buchu, 0.065; extract. triticum rip. 0.065; extract corn silk, 0.032; extract hydrangea, 0.032; atropine sulphate, 0.00013. One tablet three times a day. August 9, urine—no albumin. Man is much better but still complains of pains and cramps in legs. August 17, urine—no albumin. Same remark as above.

Case 1758.—Canuto Rivera, aged 48, male; many ova of uncin.; intense case; principal symptoms pain in pit of stomach, dizziness and debility; very pale. Admitted to hospital. Urine—no albumin. July 4, 2-25 B. N. Blaud's pills used in the intervals. July 6, urine—slight trace of albumin, no casts. This test was made by Heller's method and was probably uric acid, as I failed to confirm it on boiling. July 7, complains of pain in urination and says he has often passed small stones. Urine—albumin, no casts but much bladder epithelium and some blood. July 8, purulent discharge from the penis, but says it comes from a boil (?). Urine—many pus cells and calcium oxalate crystals; albumin. July 10, high fever and diarrhea. Urine—slight trace of albumin. July 11, urine—slight trace albumin. Furious diarrhea. Given calomel 0.013 every half hour for five doses, followed by tr. opium, three minims; tr. rhubarb, 5 minims; tr. capsicum, 5 minims; spt. peppermint, 5 minims; spt. camphor, 5 minims; administered in tablet form every three hours. July 12, has much fever. His diarrhea seems to have been due to stuffing himself with food. Urine— albumin; a few hyaline and granular casts. July 13, much fever. Added to R′ above noted bismuth-beta-naphtholate 3 grains; guaicol one-fourth grain; thymol one-eighth grain; eucalyptol one-fourth grain; one tablet every three hours. Urine—albumin. July 15, the diarrhea is as severe as ever and to limit bacterial activity he was given a solution of 1 to 1,000 aqueous solution of acetozone to drink ad libitum in addition to other medication. Urine—heavy ring by Heller's test, most of which is due to urates; albumin. July 16, urine—slight ring by Heller's test, but albumin demonstrable on boiling test. July 17, bismuth-beta-naphtholate stopped.

Man is better. No fever. Urine—slight trace. Abundance of urates. July 18, had an acute attack of hemorrhoids, small tampon soaked in 1 to a 1,000 adrenalin chloride solution. Urine—slight trace of albumin and a few hyaline casts. July 20, temperature 96. Diarrhea much less. Urine—albumin. July 21, all medication stopped. Diarrhea has ceased. July 22, urine—slight trace albumin. July 23, some uncin. ova, 3–20 thymol. Blaud's pills used from time forth in the intervals. July 24, urine—albumin. Normal temperature; no diarrhea. July 27, urine—albumin; much uric acid; many bladder cells and a very few hyaline casts. July 28, urine—slight trace of albumin and a few hyaline casts. July 30, some uncin. ova, 3–20 thymol. Has rather severe acute conjunctivitis. July 31, urine—slight trace of albumin. August 1, urine—slight trace of albumin. Has general edema to an alarming degree. Given powdered digitalis leaves, 1 grain; strychnine sulphate, one-sixtieth grain; caffeine one-half grain; extract cactus grandiflora one-half grain; one tablet every three hours. August 6, 3–20 thymol. Urine—after dose, no albumin. August 7, 8, and 9, albumin in urine. August 13, much less edema; only seen now in feet. Some uncin. ova, 4-20 thymol. August 15, all edema has disappeared. Stopped heart stimulant. August 15, 16, and 17, urine—albumin. August 20, few uncin. ova, 4-20 thymol. August 27, some uncin. ova, 4-20 thymol. August 28, urine—trace albumin. September 2, some uncin. ova, 4-20 thymol. September 10, few uncin. ova, 4–20 thymol. Urine—before dose, albumin; many mucus threads, calcium oxalate crystals, few kidney cells, and a very few hyaline and granular casts. September 17, few uncin. ova, 4–20 thymol. September 24, no uncin. ova. September 26, no uncin. ova, 4–20 thymol. October 21, no uncin. ova. Discharged cured. Is the picture of health and cured of all save "la pereza" (laziness). Known as "El sargento de los vagos" ("The sergeant of the tramps".)

Case 54.—Zacarías Colón, aged 35, male; some uncin. ova; intense case with usual symptoms, plus intense jaundice. Admitted to clinic in dispensary. June 5, 3–30 B. N. June 11, still many uncin. ova, 3–25 B. N. June 18, still uncin. ova, 3–25 B. N. June 25, 3–25 B. N. July 1, few uncin. ova, 3–25 B. N. Blaud's pills begun. July 8, many uncin. ova, 2–15 B. N. Urine—slight trace albumin and tremendous quantity of bile pigment; hyaline casts. Is profoundly jaundiced. July 15, few uncin. ova, still very much jaundiced; given one-half grain podophyllin and 2 grains calomel. July 22, some uncin. ova, 2–15 B. N. July 29, few uncin. ova; the man is really quite sick and was admitted to hospital. He has a most intense golden yellow jaundice. Was placed on nitro-muriatic acid, 5 drops t. i. d., and sodium phosphate 15 grams, a. m. and p. m. Urine—much bile pigment; granular and hyaline casts and albumin; no urobilin. July 31, urine—albumin but not so much bile pigment. August 1 and 6, urine—albumin and bile pigment in excess. August 7, urine—albumin and excess of bile pigment. August 8, man much improved. Urine—still albumin but a great reduction in bile pigment. August 9, urine—albumin. August 16, urine—slight trace of albumin. August 17, urine—trace albumin. Thymol 4–20. August 19, urine—no albumin. August 20, jaundice has nearly disappeared. August 23, severe diarrhea; tannic acid 0.25 every three hours. August 27, diarrhea checked; stopped tannic acid. August 28, urine—very slight trace albumin; no excess bile pigment. Very few uncin. ova, 4–20 thymol. September 9, discharged from hospital apparently well. September 11, few uncin. ova, 4–20 thymol. Urine—before drug, very slight trace of albumin, so slight as to raise question; no excess bile pigment; no casts. September 18, no uncin. ova, 2–20 B. N. September 25, 2–20 B. N. October 2, no uncin. ova. Discharged cured.

Case 1772.—Tomas Sierra, male; many uncin. ova; very intense case. This was one of the worst cases we had, with all the symptoms of a very intense case, edema of legs and high degree of ascites; has severe pain in lumbar region and complete prostration. July 4, urine—much albumin and great number of hyaline; granular and fatty casts; urine very pale straw color. July 5, as man was apparently about to die from uncinariasis, given 1–15 B. N. Blaud's pills given in the intervals. July 7, urine—no albumin (!). July 8, given 5 drops of tincture of digitalis every three hours. Urine—no albumin (!). July 10, 11, and 12, urine—no albumin (!). July 12, tremendous general anasarca. Given one tablet of the following every three hours: Powdered digitalis leaves, 1 grain; strychnine sulphate one-sixtieth grain; caffeine, one-half grain; extract cactus grandiflora, one-half grain. July 13, some uncin. ova, thymol 2–20. Urine—before drug, no albumin; two hours after drug, no albumin. July 15, 16, 17, 18, and 20, urine—no albumin. July 21, some uncin. ova, 3–20 thymol. Urine—after drug, slight trace albumin. July 22, urine—much albumin. July 27, thymol 4–30. Urine—after drug, much albumin, many mucous threads, and few casts, one blood cast. July 28, urine—dark green in color. July 31, better. Urine—much albumin. August 1, urine—albumin. August 3, few uncin. ova, 2–20 B. N. August 4, all feces of 24 hours saved; no uncinaria found after careful search. Has

severe dyspepsia. Given soda mint tablets. August 6, 7, and 8, urine—much albumin. August 8, given 20 drops of sweet spirits of niter and 40 drops of spirits of Mindererus three times a day. August 12, 2-15 thymol; no ova uncin. August 16 and 17, urine—much albumin. August 18, no ova uncin.; discharged hospital, apparently well but still suffering from the chronic nephritis he had at entrance. Has slight edema of legs.

Case 1774.—José Cristino Figueroa, aged 25, male; many ova uncin.; medium case. His chief symptoms are the usual ones pertaining to the stomach and circulatory systems of a medium case of uncinariasis, complicated by those of a chronic dysentery which he has had some years. Admitted to hospital. July 4, urine—no albumin. July 6, urine—before drug, no albumin. Given 2-20 B. N. Blaud's pills used in the intervals. July 7, 8, and 11, urine—no albumin. July 12, urine—no albumin. July 13, some uncin. ova, 2-20 B. N. Urine—after drug, no albumin. July 14, 15, and 16, urine—no albumin. July 20, few ova uncin., 2-25 B. N. Urine—after drug, no albumin; abundance of urates. July 22 and 24, urine—no albumin. July 27, some uncin. ova, 2-20 B. N. Urine—before drug, no albumin. July 28, 31, urine—no albumin. August 1, some uncin. ova, 2-20 B. N. Urine—after drug, no albumin. August 7, urine—no albumin. August 8, some uncin. ova, 2-20 B. N. Urine—after drug, albumin. August 9, as result of B. N. the feces of the last 24 hours contained 15 uncinaria, one pair in act of copulation. Urine—no albumin. August 14, some uncin. ova, 4-20 thymol. August 16, urine—trace albumin. August 21, few uncinaria ova, 4-20. Has severe neuralgia and pronounced dyspepsia. August 26, few ova uncin., thymol 4-20. Discharged hospital, apparently well save a chronic nervous dyspepsia. August 28, urine—no albumin. December 16, absolutely no albumin; Hb., 110 per cent. Suffers very little now from stomach due to taking pepsin comp. Has headache, dizziness, and roaring in ears.

Case 1890.—Leonarda Marrero, female; great many uncin. ova, very intense case. Aged 50. June 29, 2-15 B. N. Blaud's pills used in the intervals. July 2, urine—no albumin. July 4, urine—no albumin. Many uncin. ova., 2-20 B. N. July 6, urine—albumin; no casts on careful examination but many epithelial cells, free erythrocytes and vaginal epithelium; cells from the pelvis of the kidney, in sheets like oyster shells. July 7, 8, 10, and 11, urine—albumin. July 12, 14, and 15, urine—much albumin and diarrhea. July 16, thymol, 3-20. Urine—albumin. July 17, 18, 20, and 22, urine—albumin. July 23, few uncin. ova, 4-20 thymol. July 24, urine—albumin. July 27, urine—slight trace albumin. July 30, 3-20 thymol, no uncin. ova. July 31, urine—slight trace albumin; great abundance of blood, pus, fibrin, and imbricated masses of cells from the pelvis of the kidney; no casts. August 1 and 3, urine—no albumin. August 5, no uncin. ova. August 6, 7, 8, urine—albumin. Discharged hospital, cured.

Case 2069.—Julio Santiago, aged 23, male; very intense case, with edema; many ova of uncin. July 12, urine—slight trace of albumin on boiling but none by nitric acid. Hb., 50 per cent. July 13, 2-20 B. N. Urine—after B. N., no albumin. Blaud's pills used. July 14, urine—slight trace of albumin. July 15, diarrhea. Treated by calomel first and then paregoric. Urine—no albumin. July 16, urine—trace albumin. July 17 and 18, urine—no albumin. July 19, diarrhea stopped. July 20, urine—no albumin. July 21, 3-20 thymol. July 22, urine—no albumin after thymol. Thymol 3-20. July 23, diarrhea. July 24, urine—no albumin; much urates. July 25, urine—albumin, very few casts and much mucin. July 28, urine—much albumin. July 31, urine—much mucin and many calcium oxalate crystals; no casts; some renal cells; very slight trace of albumin. August 1, urine—albumin. August 3, all diarrhea stopped after treating continually with opium, bismuth, and, finally, silver nitrate pills. August 6, urine—no albumin. August 7, urine—very faint trace of albumin. August 8, some ova uncin., 4-20 thymol. Urine—no albumin. August 9, after careful search of the stools of the 24 hours following the thymol found 15 uncin. August 13, urine—no albumin. No uncin. ova, 2-20 B. N. Hb., 58 per cent. Discharged hospital.

THE RIO PIEDRAS SERIES OF 1906.

First group. This group has an advantage over the second in that the histories are more complete.

Second group. Nearly all of these cases had eucalyptol, which accounts for their short stay in hospital.

FIRST GROUP.

Case 1.—J. S., Yabucoa. Admitted November 12, 1906; age, 14; male; white; laborer. At age of 10 had malaria. Four or five months ago his present illness began. Poor food. Mazamorra contracted in a banana plantation. Mucous membranes pallid. Skin dry and harsh. Is well nourished and well developed. Appetite good. Gastralgia at times before meals. Sometimes vomits; tongue somewhat coated; epigastric and general abdominal tenderness; constipation; feces normal, save for mucus and many ova of uncinariæ and trichocephalus. A little dyspnea; palpitation and pain in heart, latter especially in the morning. Pulse regular, weak, and compressible. Heart hypertrophied and dilated; hemic murmurs. Pain in chest. Is always dizzy. Tinnitus aurium. Temporo-frontal headache. Somnolent. Reflexes good. Intelligence fair. Blurred vision in right eye. Muscles weak and flabby. Temperature normal. Edema of lower extremities.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 12	44	5,084,000	7,800	10.8	68.0	18.4	2.4	0.4
Dec. 4	51	5,266,400	8,000	31.2	45.2	14.8	8.0	.8

Diagnosis.—Acute uncinariasis.

Treatment.—November 13, 3–25 thymol; November 20, same; November 27, same; December 3, same; December 4, same.

Result.—Cured.

Case 2.—P. G., Rio Piedras, barrio Mameyes. Admitted November 14, 1906; age 42; male; mulatto; single; laborer in coffee and banana plantations. Father died of anemia. Patient has been sick four years; food poor; had mazamorra for the last time a year ago. Marked pallor. Development good; no emaciation. Slight edema of face and considerable of lower extremities; suffers from pruritus. Skin dry and harsh. Good appetite; no gastralgia; has nausea; vomits, especially at night; tongue pale and coated; stomach and abdomen are tender; constipation and enteralgia; yellow feces with a little mucus; many ova of uncinariæ and a few of trichocephalus. Suffers from dyspnea and palpitations, but no pain in heart. Pulse weak and compressible. Pain in chest; frequent dizziness; tinnitus aurium; sleeps anywhere he sits down; mentality slow. Reflexes and tactile sense good. No impotence. Blurred vision. Muscles flabby, weak, sore, and painful.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 14	19	2,671,040	4,800	7.6	72.0	17.2	2.4	0.8
Dec. 29	29	3,191,040	6,400	14.0	62.0	21.2	2.8	.....

Treatment.—November 14, thymol 4–25; December 1, thymol 3–25.

Result.—Improved. Would not consent to stay in hospital longer.

Case 3.—H. M., Rio Piedras, barrio Frailes. Admitted December 29, 1906; age, 20; male; white; single; laborer in country; has been sick two years; has had mazamorra. Extreme pallor of conjunctivæ; some emaciation; poor general development; had such edema of face at times as not to be able to open his eyes; edema of legs; pruritus; skin dry and harsh. No appetite; severe gastralgia; no nausea or vomiting, but does suffer from meteorism; much diarrhea; many ova of uncinariæ. Great dyspnea; palpitations and pain in heart marked. Pulse weak and compressible. Hypertrophy of heart; *bruit-de-diable;* pain in chest. Much dizziness and tinnitus aurium. Temporal headache; insomnia; mental condition poor. Frequent syncope. Is intelligent. Weakness. Muscles flabby and painful.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 29	18	2,502.160	8,200	6.8	78.8	11.6	2.4	0.4

Diagnosis.—Chronic uncinariasis.

Treatment.—December 29, sod. sulphat., 35 grams. December 30, beginning in the morning, he took the following formula, divided into three doses, one dose every 15 minutes: Eucalyptol, 2; chloroform, 3; castor oil, 40. After this dose 410 uncinariæ were expelled, all alive.

The drug caused such severe collapse that hypodermics of strychnine had to be administered. January 3, 1907, same formula, but divided into two doses. Expelled 32 uncinariæ. Same severe reaction. January 24, same formula, but divided into three doses. Expelled 2 uncinariae. Same reaction. February 3, same formula; same reaction, and expelled 3 uncinariæ. February 12, same dose; expelled no uncinariæ. After a month's rest from this severe treatment, he was allowed to recuperate and was then given 4 grams of thymol, as he had many ova of uncinariæ in his stools. His stool was lost and so, unfortunately, nothing was known of the number expelled.

Result.—This man is entirely cured, is strong, of good color, and is now working as messenger in the office of the director of the transmissible diseases service.

Case 4.—A. C., Rio Piedras, barrio Caimitas. Admitted November 2, 1906; age, 70; male; white; single; laborer; mother died of uncinariasis; patient has had dysentery, asthma, spasms, and varicella. Two years ago suffered a severe infection from mazamorra. Is very pale and a little emaciated. Fair development. Edema of lower extremities; atrophy of the skin; skin dry and harsh. Not much appetite; gastralgia; nausea; tongue pallid, deeply seamed and dotted with black spots; flatulence; tenderness of abdomen; meteorism; constipation; feces normal, save for a little mucus; many ova of uncinariæ. Dyspnea, palpitations, and pain in heart. Pulse weak and compressible. Pain in chest; dizziness; tinnitus aurium; headache. At times syncope. Reflexes are normal. Blurred vision. Muscles flabby, painful, sore, and weak.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 2	8	1,542,160	3,600	39.6	43.2	11.2	5.6	0.4
11	9	1,768,800	4,000	24.8	44.4	16.4	13.6	.8
Dec. 10	16	2,673,200	3,200	6.4	56.0	30.4	6.8	.4
29	16	2,017,600	4,000	3.2	69.6	17.2	9.2	.8
Feb. 5	50	.....	.....	.....	.....	.....	.....	.....

Diagnosis.—Chronic uncinariasis.

Treatment.—November 2, thymol 3–20; expelled 150 uncinariae and 1 trichocephalus. November 12, thymol 4–25; expelled 433 uncinariae. November 29, thymol 4–35; expelled 247 uncinariae. December 10, thymol 4–25; expelled 82 uncinariae. December 20, thymol 4–25; expelled 2 uncinariae. January 23, thymol 4–35; expelled 35 uncinariae.

Result.—Cured of all save his anemia, which is rapidly disappearing. He was discharged with 50 per cent Hb., after four careful examinations of feces, which were all negative.

Case 5.—R. R., Rio Piedras, barrio Cupey. Admitted October 26, 1906; age 30-male; white; laborer; mother died of uncinariasis; measles at 12 years of age; infection 4 years ago; food poor, chiefly vegetable; mazamorra frequent in coffee plantation and swamps. Skin dry and harsh. Appetite good; gastralgia so severe as to make him cold all over; nausea; vomits at times after meals; tongue coated; abdominal tenderness; much diarrhea; enteralgia; feces normal, save for a little mucus; many ova of uncinariae, few of trichocephalus. Little dyspnea; pain in heart and palpitation. Pulse weak and compressible. Pain in chest; extreme dizziness; frontal and temporal headache; pain in his joints; insomnia; reflexes normal. Extremities and face edematous.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Oct. 26	21	2,461,600	5,600	20.0	47.6	20.0	10.8	1.6
Nov. 2	29	2,720,000	7,000	17.2	56.4	17.2	6.4	2.8
16	26	3,000,200	6,800	8.4	55.6	31.6	3.6	.8

Diagnosis.—Chronic uncinariasis.

Treatment.—October 26, thymol 4–25; expelled 792 uncinariae. November 7, thymol 4–25; expelled 50 uncinariae. November 17, thymol 4–25; expelled 6 uncinariae. November 28, thymol 4–25; expelled 26 uncinariae.

Result.—Cured, 85 per cent Hb.

Case 6.—C. F., Carolina, barrio Piedras Blancas. Admitted December 15; age 29; male; white; laborer. Mazamorra from working in trenches. Extreme pallor; edema of face very severe; both extremities same; skin dry and harsh. No appetite; severe gastralgia; flatulence; diarrhea; enteralgia; feces normal, save for many ova of uncinariae and few of trichocephalus. Intense dyspnea; marked palpitation and pain in heart. Pulse weak and compressible. Heart hypertrophied and dilated. *Bruit-de-diable.* Much dizziness; parietal headache; tinnitus aurium.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 15	19	2,915,200	8,000	10.4	70.0	15.6	2.8	1.2

Diagnosis.—Chronic uncinariasis.

Treatment.—December 15, 35 grams sod. sulphat. at night. December 16, early in the morning given: Eucalyptol, 2; chloroform, 3; castor oil, 40; taken in three doses 15 minutes apart. Vomited one dose; had vertigo and had to be aroused from collapse by hypodermic stimulation. Expelled 91 uncinariae. December 21, sod. sulphat. 40. Next day took eucalyptol in same combination, but of the three doses into which this was divided he only had two. Expelled 110 uncinariae. December 29, sod. sulphat. 45. Next day took eucalyptol as per above in three doses. Expelled 42 uncinariae. January 6, sod. sulphat. 45. Next day took eucalyptol as per above, but in two doses. Expelled 35 uncinariae.

Result.—Cured.

Case 7.—J. G., town of Caguas. Admitted November 20, 1906; age 8; female; white; has mazamorra; infected in a near-by field; skin dry and harsh; eats uncooked rice; very pale; no appetite; feces normal, save for a tremendous number of ova of uncinariae and a few of trichocephalus. Suffers from palpitations of the heart and dizziness, but pulse full and strong. Tinnitus aurium. Very weak; gets tired easily and has frontal headache. Edema of lower extremities.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 20	30	3,275,200	6,000	4.4	57.2	31.6	6.0	0.8

Diagnosis.—Acute uncinariasis.

Treatment.—November 20, 12 grams sod. sulphat. November 21, eucalyptol, 1; chloroform, 1.5; castor oil, 25. Every 20 minutes she had one of the three portions into which this dose was divided. At 11.45 a. m., or 3 hours after this dose of eucalyptol, she was given 0.5 of eucalyptol, 1 gram chloroform and 10 of castor oil. After these doses she expelled 11 uncinariae. December 6, sod. sulphat., 12. Next day she took eucalyptol, 2; chloroform, 3; castor oil, 40. This was prepared to take in three doses, but she only took two. Expelled 260 uncinariae.

Result.—This child left the hospital simply because of the terrible effect of the drug.

Case 8.—P. L., Rio Piedras, barrio Monacillo. Admitted November 19, 1906; age, 54; male; mulatto; laborer in country; mazamorra in the last coffee harvest; has been sick 14 years. Very pale; edema of scrotum and lower extremities. Skin dry and harsh. Gastralgia; sometimes nausea and vomiting; tongue coated; appetite poor; feces normal save for many ova of uncinariæ and a few of trichocephalus. Has dyspnea, palpitations, and pain in heart. Pulse weak and compressible. Much dizziness and constant tinnitus aurium. Temporo-occipital headache. Reflexes normal.

Date.	Blood.							
	Hb	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 19	20	3,613,280	6,200	8.4	64.0	20.0	7.6	.....
Dec. 4	28	3,728,880	6,600	9.2	64.0	18.8	7.2	0.8

Diagnosis.—Chronic uncinariasis.

Treatment.—November 19, sodium sulphate, 25. November 20, early in the morning, eucalyptol, 2; chloroform, 3; castor oil, 40. Taken in three doses, one every 20 minutes. Syncope ensued after last dose, and it was necessary to stimulate hypodermically. Expelled 1,059 uncinariæ. November 22, sodium sulphate, 25. November 23, eucalyptol as above described. First evacuation expelled 721 uncinariæ; the second 10. November 28, same treatment; expelled 2 uncinariæ.

Result.—Cured; discharged December 17, hemoglobin 48 per cent; no ova of uncinariæ in feces.

Case 9.—G. S., Rio Piedras, barrio Cupey. Admitted January 30, 1907; mulatto; age, 40; laborer; mazamorra from working in trenches. Very pale; marked emaciation; development normal. Edema at times in extremities; skin dry and harsh; papular eruption on chest. Appetite good; gastralgia at times; nausea at times; tongue clean; no flatulence; slight epigastric tenderness; diarrhea; slight enteralgia at times; feces bright yellow, semiliquid, with a slight amount of mucus and many ova of uncinariæ. Dyspnea slight in repose, but marked on exertion. Palpitation of heart. Pulse 55 per minute, regular and full. Slight cough. Pain in chest. Dizziness, marked and frequent; tinnitus aurium; frontal headache. Insomnia at times; patellar reflexes are diminished; dull expression. Blurred vision. Muscles flabby. Cramps in lower extremities. At times soreness of muscles. General weakness.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Jan. 30	30	3,708,000	8,800	11.6	62.0	12.8	13.2	0.4

Diagnosis.—Chronic uncinariasis.

Treatment.—January 31, sodium sulphate, 25. February 1, eucalyptol, 3; chloroform, 2; castor oil, 40. Expelled 2 uncinariæ. February 4, same doses; expelled 2 uncinariæ. February 13, same doses; expelled 8 uncinariæ and 1 trichoceph. February 19, same dose; no uncinariæ. February 23, same dose; no uncinariæ. February 26 and 28, no ova in feces.

Result.—This man left the hospital, promising to return, but he did not do so.

Case 10.—P. C., Bayamon, barrio Camarones. Admitted December 12, 1906; age 32; male; white; laborer; works on his own farm; eats uncooked rice and chews tobacco. Mazamorra from the swamps and the banana plantations; has been very sick for a year; somewhat pale; edema of face and legs at times; skin dry and harsh. Not much appetite; sometimes nausea, no vomiting; constipated; feces normal, save for ova of uncinariæ and a few of trichocephalus. Fom time to time dyspnea; palpitation and pain in heart; pain in chest; tinnitus aurium; fronto-temporal headache; insomnia; mental condition good; reflexes normal and expression of face also normal. Blurred vision. Muscles flabby and weak, but pulse full and strong.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 12	49	5,613,280	7,600	21.2	53.6	20.0	4.8	0.4

Diagnosis.—Chronic uncinariasis.

Treatment.—December 13, sodium sulphate, 30. December 14, eucalyptol, 2; chloroform, 3; castor oil, 40.

Result.—Left hospital, probably disgusted with treatment.

Case 11.—Q. G., Rio Piedras, barro Hato Rey. Admitted October 23, 1906; age, 28; male; white; laborer in coffee plantations; mazamorra from swamps; has been sick a year or two. Very pale; edema of lower extremities; skin dry and harsh. Good appetite; no gastralgia, nausea, nor vomiting; slight flatulence; tenderness of abdomen; meteorism slight; diarrhea; many ova uncinariæ and a few of trichocephalus. Spleen normal; liver somewhat enlarged. A good deal of dyspnea. Palpitation of heart and precordial pain. Pulse weak and compressible. Hemic murmur and heart dilated; pain in chest. Tinnitus aurium and dizziness. Temporal headache; insomnia; often has syncope.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Oct. 23	8	1,384,000	6,600	22.4	63.2	10.8	2.0	1.6
Nov. 1	9	1,639,600	5,800	26.8	51.6	15.6	5.6	.4
16	14	1,972,800	9,000	13.6	69.2	14.4	4.0	.8

Diagnosis.—Chronic uncinariasis.

Treatment.—October 23, thymol 4–25; expelled 1,198 uncinariæ. November 1, thymol 4–25; expelled 328 uncinariæ. November 16, thymol 4–25; expelled 98 uncinariæ. November 29, thymol 4–25; expelled 20 uncinariæ. January 15, 20, 24, 26, no ova uncinariæ in feces.

Result.—Cured of all save anemia; Hb., 42 per cent.

Case 12.—A. J., Rio Piedras, barrio del Rio. Admitted October 29, 1906; mulatto; age 60; male; laborer; had mazamorra; infected in banana plantation. Very pale; edema of lower extremities; skin dry and harsh; appetite good. Feces normal, save a good many ova of uncinariæ and some trichocephalus. Has dyspnea, palpitation, and pain in heart. Pulse weak and compressible. Heart hypertrophied and dilated. Hemic murmur. Pain in chest. Tinnitus and dizziness. Headache. Syncope; great weakness.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Oct. 29	19	1,898,400	4,400	10.8	52.0	32.8	3.2	1.2
Nov. 7	23	2,102,000	3,400	24.0	30.0	41.2	4.4	.4

Diagnosis.—Chronic uncinariasis.

Treatment.—October 29, thymol 2.5 grams and 25 sod. sulphat.; expelled 156 uncinariæ and 1 trich. November 8, thymol 4-25; expelled 148 uncinariæ. November 28, thymol 4-25.

Result.—Left hospital with 27 per cent Hb. on 28th of November. Died in the country afterwards; cause of death probably due to some cardiac complication.

SECOND GROUP.

Case 1.—Serial No. 2005. H. A., Vega Baja. Admitted November 16, 1906; mulatto; age 18; male; laborer; mazamorra from swampy ground. Has had mazamorra every year for four or five years. Came to hospital with fever which was malarial; the parasites were found in the blood. Partial symptomatology; pain in heart, with palpitation; frontal headache; tinnitus aurium; great dizziness and weakness; has many ova of uncinariæ and few trichocephalus in feces.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 16	76	4,964,000	7,000	4.4	68.4	24.8	2.4	.....

Diagnosis.—Acute uncinariasis.

Treatment.—November 17, sod. sulphat., 25. November 18, eucalyptol, 2; chloroform, 3; castor oil, 40; administered in three doses as usual. Expelled 561 uncinariæ.

Result.—Cured.

Case 2.—Serial No. 2267. J. S., Puerta de Tierra. Admitted January 2, 1907; white; age 50; male; laborer; mazamorra from stepping into certain wet spots; eats raw rice; has many ova of uncinariæ in feces and a few of trichocephalus. Otherwise has usual symptoms of medium case.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Jan. 2	33	3,591,040	10,800	18.0	56.0	18.4	6.8	0.8

Diagnosis.—Chronic uncinariasis.

Treatment.—January 2, sod. sulphat., 35. January 3, eucalyptol as in previous case. Had severe dizziness; expelled 21 uncinariæ.

Result.—Left hospital as result of drug.

Case 3.—Serial No. 2014. R. F., Santurce. Admitted November 6, 1906; white; age 40; male; laborer; mazamorra acquired in wet spots. The prominent symptoms in this case were mental confusion, temporo-frontal headache, palpitation of the heart, and deafness. He had no dizziness nor did he suffer from weakness (!). There was a decided hemic murmur. Has edema of the face. Many ova of uncinariæ and a few of trichocephalus in feces.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Nov. 6	32	3,864,000	6,000	10.0	67.6	22.0	0.4	.....
30	37	3,684,400	6,600	4.4	79.2	7.6	8.0	0.8
Dec. 30	40	.....	.....	.....	.....	.....	.....	.....
Apr. 6	100	.....	.....	.....	.....	.....	.....	.....

Diagnosis.—Chronic uncinariasis.

Treatment.—Thymol, which he took in the usual manner five times in 4-gram doses on each occasion.

Case 4.—Serial No. 2234. E. L., Santurce. Admitted December 21, 1906; mulatto; age 20; male; messenger; mazamorra from wet places. Chief symptoms are pallor, weakness, dizziness, palpitation of the heart. Has many ova of uncinariæ in the feces.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 21	14	2,724,400	12,200	16.8	67.6	13.2	2.0	0.4

Diagnosis.—Chronic uncinariasis, intense grade.

Treatment.—Sod. sulphat., 25. December 22, eucalyptol, 2; chloroform, 3; castor oil, 40; was prepared for him to take in three doses, 15 minutes apart, but he could only take two. Expelled 5 uncinariæ. December 26, sod. sulphat., 30. December 27, exactly same as recited for the 22d of December. Expelled 220 uncinariæ. A careful examination of the expelled parasites revealed the fact that all were of the species anchylostoma duodenale. This is the first time that this parasite has been found in a Porto Rican who had never been out of the island.

Case 5.—Serial No. 2128. F. C., Rio Piedras, barrio Monacillo. Admitted December 7, 1906; white; age 25; male; laborer; mazamorra from coffee plantation. Usual symptoms of a benign form of the disease. Has many ova of uncinariæ and a few of trichocephalus.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 7	70	5,906,400	7,000	18.0	67.2	11.6	2.4	0.4

Diagnosis.—Acute uncinariasis.

Treatment.—December 7, sod. sulphat., 25. December 8, eucalyptol, 2; chloroform, 3; castor oil, 40. This was taken in two doses and he failed to expell a single parasite. December 11, sod. sulphat., 35. December 12, took the same dose of eucalyptol in the same way and a short time after the last dose was given 10 grams more of castor oil and 10 drops of eucalyptol. This caused him to expell 45 uncinariæ. December 31, sod. sulphat., 25, followed the next day by the usual formula of eucalyptol. This treatment was repeated February 16 and 19, but the record of number of uncinariæ expelled was not made.

Result.—Cured. Hb., 78 per cent.

Case 6.—Serial No. 2177. R. S., Bayamon, barrio Santa Ana. Admitted December 12, 1906; white; age 21; male; weigher of sacks of sugar; mazamorra contracted in the coffee and banana plantations before he took up his present occupation. Principal symptoms: Debility, dizziness, roaring in the head, palpitations of heart, frontal headache, precordial pain. Many ova of uncinariæ and a few of trichocephalus.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 12	46	3,404,000	7,400	15.6	48.0	32.4	4.0	.....

Diagnosis.—Chronic uncinariasis, intense grade.
Treatment.—December 12, sod. sulphat., 30. December 13, eucalyptol, 2; chloroform, 3; castor oil, 40. This was divided into three doses, one to be taken every 15 minutes, but he only took two. Expelled 458 uncinariæ.
Result.—Left hospital and never came back.

Case 7.—Serial No. 2173. A. A., San Juan. Admitted December 11, 1906; white; age 15; male; says he never had mazamorra. Has the usual symptoms of a moderate case. Fair number of ova of uncinariæ but no trichocephalus.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 11	45	5,172,800	5,400	16.4	55.6	15.6	12.4	.....

Diagnosis.—Acute uncinariasis, medium case.
Treatment.—December 11, sod. sulphat., 25. December 12, eucalyptol, 2; chloroform, 3. This was divided into three doses to be taken in the usual manner, but he was unable to take but two; had severe dizziness and collapse, from which he had to be aroused by hypodermic stimulation. Expelled 276 uncinariæ. He refused to take a second dose of eucalyptol and so was given 3 grams of thymol the 27th of December. The uncinariæ were not counted.
Result.—Cured December 30. Hb., 85 per cent.

Case 8.—Serial No. 2291. R. R., Santurce, barrio Seboruco. Admitted January 7; mulatto; age 12; male; student; mazamorra six months ago contracted from wet spots; chief symptoms are weakness in the knees, vertigo, headache, palpitation of the heart, debility. Many ova uncinariæ; some of trichocephalus.

Date.	Blood.		
	Hb.	Red cells.	Leucocytes.
Jan. 7	14	2,097,760	7,300

Diagnosis.—Acute uncinariasis, intense case.
Treatment.—He was given the usual eucalyptol treatment and left the hospital in disgust when he had recovered from its bad effects.

Case 9.—Serial No. 2166. R. C., San Juan. Admitted December 10; white; age 16; mazamorra acquired in swampy ground. Usual symptoms. Many uncinaria ova; few of trichocephalus.

Date.	Blood.							
	Hb.	Red cells.	Leucocytes.	E.	P.	S. L.	L. L.	B.
Dec. 12	80	4,372,400	7,500	22.4	54.8	18.8	3.6	0.4

Diagnosis.—Acute uncinariasis, medium case.
Treatment.—Thymol, 3 grams, preceded the night before and followed two hours after the last dose by 20 grams of sod. sulphat.
Result.—Left the hospital improved.

Case 10.—Serial No. 2261. M. V., Carolina. Admitted December 31; negro; age 42; male; laborer; mazamorra from working in swampy land. Chief symptoms: Debility, weakness in knees, pains in body. Meteorism. No sexual desire. Dizziness, tinnitus aurium, temporo-frontal headache, palpitations of the heart, precordial pain. A good many ova of uncinariæ and a few of trichocephalus.

Date.	Blood.		
	Hb.	Red cells.	Leucocytes.
Dec. 2	31	3,951,040	5,800

Diagnosis.—Chronic uncinariasis, intense grade.
Treatment.—Took one dose of eucalyptol in form already described and disappeared.

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